A STUDY TO ASSESS THE EFFECTIVENESS OF MODIFIED ORAL CARE PROTOCOL WITH SUBGLOTTIC SUCTIONING IN REDUCING THE OCCURRENCE OF VENTILATOR ASSOCIATED PNEUMONIA AMONG INTUBATED PATIENTS IN INTENSIVE CARE UNITS AT KMCH, COIMBATORE.

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A DISSERTATION SUBMITTED TO THE TAMILNADU
Dr. M.G.R. MEDICAL UNIVERSITY, CHENNAI,
IN PARTIAL FULFILMENT OF REQUIREMENT
FOR THE DEGREE OF MASTER OF
SCIENCE IN NURSING,
APRIL 2011

CERTIFICATE

This is to certify that the Dissertation entitled ***A STUDY TO ASSESS THE EFFECTIVENESS OF MODIFIED ORAL CARE PROTOCOL WITH SUBGLOTTIC SUCTIONING IN REDUCING THE OCCURRENCE OF VENTILATOR ASSOCIATED PNEUMONIA AMONG PATIENTS IN INTENSIVE CARE UNITS, KMCH, COIMBATORE,*** *is submitted to the faculty of Nursing,* ***The Tamilnadu Dr. M. G. R Medical University, Chennai*** *by* ***Ms. I. RATHI*** *in partial fulfilment of requirement for the degree of Master of Science in Nursing. It is the Bonafide work done by her and the conclusions are her own. It is further certified that this dissertation or any part thereof has not formed the basis for award of any degree, diploma or similar titles.*

Prof. DR. S. Madhavi, M.Sc. (N)., Ph.D.,
Principal and Head of the Department of
Medical Surgical Nursing,
KMCH College of Nursing,
Coimbatore – 641 014,
Tamilnadu.

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APPROVED BY DISSERTATION COMMITTEE ON FEBRUARY 2010

1. RESEARCH GUIDE: _____

DR. N. RAJENDIRAN, M.A. (App.Psy)., Ph.D.,
Professor in Psychology and Psychologist,
Kovai Medical Center and Hospital,
Coimbatore - 641 014.

2. CLINICAL GUIDE: _____

Prof. DR. S. MADHAVI, M.Sc.(N), Ph.D.,
Principal and Head of the Department of
Medical Surgical Nursing,
KMCH College of Nursing,
Coimbatore – 641 014.

3. MEDICAL GUIDE: _____

Dr. M. N. SIVAKUMAR, D.A., DNB., I.D.C.C.,
Consultant Critical Care Physician,
Kovai Medical Center and Hospital,
Coimbatore – 641 014.

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CHAPTER-I

INTRODUCTION

The Health Care Providers and Patients face multiple challenges, where new treatment modalities and technology interfere with the continuing effort to strive for quality care and expected outcomes. Efficiency and Cost effectiveness must go hand in hand, to satisfy the patients and to improve the quality of care. While encouraging the innovations, it makes a sense; their drastic effects need to be screened.

The development of sophisticated technology, support and elaborate medical interventions, which help many patients to walk out of the hospital, which was unimaginable a few decades back. In order to gain maximum benefits out of advanced technologies, it is mandatory for the health care professionals to follow standard guidelines to prevent nosocomial infections.

The prevalence of nosocomial infection is higher in Intensive Care Units (ICU) than in the general hospital wards. Catheter related infections, Ventilator Associated Pneumonia and surgical site infections cause the majority of these nosocomial infections. Nosocomial infection increases the mortality, morbidity and cost. The length of hospital stay, stay in ICU, and duration of mechanical ventilation are higher in those patients. Utilization of invasive devices is the major risk factors for the development of nosocomial infections in ICUs. But the critical conditions of many patients in ICUs warrant the support of invasive devices. Adherence to preventive measures by ICU staffs is crucial in reducing nosocomial infections. Implementation of evidence based infection control measures should be the basis for the prevention of nosocomial infection (Rello et al. 2007).

Ventilator Associated Pneumonia (VAP) is one of the common nosocomial infections in ICU. VAP is the second leading cause of morbidity and mortality in the intensive care unit after urinary tract infection. The incidence of VAP was 86% and mortality rates exceed 59%. Once the patient has developed VAP, additional requirement of treatment increases the length of stay by up to 22 days and raises the cost of care. 86% of nosocomial pneumonia was associated with intubation and mechanical ventilation. The most frequent isolates from pneumonia were Gram-negative aerobic organisms (64%) such as Pseudomonas Aeruginosa (21%) and Acinetobacter (18%). Staphylococcus aureus (20%) was also isolated with similar frequency, among hospitalized patients in United States (Mehta et al. 2003).

Most episodes of ventilator-associated pneumonia (VAP) are developed from the aspiration of oropharyngeal secretions containing potentially pathogenic organisms. Aspiration of gastric secretions may also contribute to the development of VAP, though likely to a lesser degree. Interruption of the body's anatomic and physiologic defenses against aspiration by tracheal intubation makes mechanical ventilation a major risk factor for VAP. Patients affected with pulmonary infection are economically overburdened in addition to the treatment of the primary condition.

VAP is a preventable secondary consequence resulting from intubation and mechanical ventilation. VAP can be prevented by a combination of interventions which constitutes the VAP bundle. VAP bundle includes head end elevation, hand hygiene, sedation holidays, Deep Vein Thrombosis (DVT) prophylaxis, ulcer prophylaxis and oral care. A novice aspect that can be included in VAP bundle is Subglottic Suctioning. Each aspect of VAP bundle is aimed to prevent the aspiration of secretions containing bacteria into the sterile lower respiratory tract (Mayhall, 2004).

Poor oral hygiene causes the microorganisms to colonize in the oropharynx. There is a chance of aspiration of these microorganisms to the lower respiratory tract, causing pneumonia. The chance of aspiration is very high among the patients who are unconscious or semiconscious, intubated and mechanically ventilated. Growth of potentially pathogenic bacteria in dental plaque provides a nidus of infection for microorganisms which result in development of VAP. Dental plaque provides a microhabitat for pathogenic organisms and provides opportunity for

adherence either to the tooth surface or to other microorganisms. This microorganism in the mouth gets translocated and colonizes the lung, which can result in VAP.

Removing bacteria from oropharynx requires the removal of dental plaque, and proper oral hygiene is the only way to remove plaque. Majority of nurses use a soft toothette instead of tooth brushing and the toothettes do not remove plaque as effective as toothbrushes; consequently, oral bacteria can proliferate (Berry et al. 2007).

In normal endotracheal tube there is collection of secretions just above the cuff, which cannot be effectively removed by routine oral suctioning. Amount of secretions pooling above the cuff of endotracheal tube can be minimized by continuous or intermittent aspiration of the secretions which prevent micro aspiration. This can be done by the use of a special endotracheal tube having an additional dorsal lumen called subglottic suctioning port.

Use of continuous aspiration of subglottic secretions in intubated patients reduced the incidence of ventilator-associated pneumonia by 43.4%. This decrease was caused by a significant reduction in the incidence of pneumonia during the initial days of mechanical ventilation. Subglottic suctioning represents a simple, inexpensive, and useful approach in the prevention of nosocomial pneumonia. It primarily reduces the risk of pneumonia, caused by indigenous flora already present in the oral cavity of patients at the time of intubation. Furthermore, this measure helps to reduce the antibiotic dosage when combined with other methods of prevention (Lacherade et al. 2010).

NEED FOR THE STUDY:

Aspiration is a potential hazard for the patient with an endotracheal tube. Oral intubation increases salivation and swallowing is difficult, causing pooling of secretions. So proper oral hygiene, frequent oral suctioning and subglottic aspiration is very essential to prevent oral colonization of microorganisms and their transduction to lung tissue.

Nursing education regarding oral care practices for mechanically ventilated patients has not been updated or modified recently. Oral care is often considered as an intervention for patient comfort rather than a need to promote health. This contributes to the decreased attention, priority and frequency of plaque removal. Hence attention to the oral care of intubated patients using a modified oral care protocol is emphasized.

Microbial colonization of the oropharynx and dental plaque has been associated with systemic and respiratory diseases, most notably ventilator-associated pneumonia (VAP). VAP affects 8% to 28% of patients receiving mechanical ventilation, with mortality rates ranging from 24% to 50%. Mortality rates may be as high as 76% for infections caused by high-risk pathogens such as Pseudomonas or Acinetobacter. Prolonged ICU and hospital stays result in increased costs (Cutler et al. 2005).

Meticulous mouth care is crucial in prevention of VAP. The buccal cavity and dental plaque act as perfect media in which bacteria can colonize. 40% - 60% of endogenous lung infections are due to aspirated oropharyngeal secretions. 20% - 40% of these bacteria were staphylococcus aureus, and more than half of them are methicillin resistant (Porzecanski et al. 2006).

Grap et al. (2009) quoted that bacteria reside in plaque and are transmitted to the lungs via micro aspiration. Dental plaque can be removed only by tooth brushing. The study demonstrated that tooth brushing is an effective way to reduce the incidence of VAP as it removes the plaque that harbors bacteria.

The development of nosocomial pneumonia depends on the virulence of the bacterial species, the size of inoculum, and the capacity of the pulmonary defense mechanisms. With the suctioning of subglottic secretions, the volume of oropharyngeal secretions aspirated into the bronchial tract and the size of inoculum are lowered. Thus continuous aspirations of subglottic secretions in intubated patients reduce VAP episodes.

Manual intermittent aspiration of subglottic secretions shows a decrease in the incidence of ventilator-associated pneumonia and a delay in the emergence of pneumonia during

mechanical ventilation. Endotracheal tubes used are those with a subglottic suctioning port. Subglottic secretions were aspirated hourly. This intervention represents a simple, inexpensive, and useful approach in the prevention of nosocomial pneumonia. (Mahul. et al 2006).

Ventilator Associated Pneumonia is one of the leading causes of mortality and morbidity in critically ill patients. Proper implementation of the prevention protocol is essential in preventing VAP and thereby reducing the economical, personnel and material resources. So the investigator felt the definite need for Subglottic suctioning and developing a modified oral care protocol for intubated patients.

STATEMENT OF THE PROBLEM:

A study to assess the Effectiveness of Modified Oral Care Protocol with Subglottic Suctioning in reducing the occurrence of Ventilator Associated Pneumonia among intubated patients in Intensive care units at KMCH, Coimbatore.

OBJECTIVES:

Objectives of the study were to:

1. estimate the occurrence of Ventilator Associated Pneumonia among patients receiving routine oral care
2. determine the occurrence of Ventilator Associated Pneumonia among patients receiving modified oral care protocol with subglottic suctioning.
3. compare the effectiveness of modified oral care protocol and subglottic suctioning with the routine oral care in reducing the occurrence of ventilator associated pneumonia.

OPERATIONAL DEFINITIONS:

EFFECTIVENESS:

Effectiveness refers to the reduction in the occurrence of Ventilator Associated Pneumonia.

MODIFIED ORAL CARE PROTOCOL:

It is a modified protocol framed by the researcher after reviewing recent research evidences on oral care for intubated patients, with the main focus to minimize the oropharyngeal bacterial colonization.

SUBGLOTTIC SUCTIONING:

It means the continuous suctioning of the subglottic secretions by means of a special endotracheal tube provided with a dorsal lumen above the cuff, which is connected to a suction apparatus, which allows for suctioning of secretions from the subglottic area at a minimal pressure of 20 mmHg.

VENTILATOR ASSOCIATED PNEUMONIA:

Ventilator Associated Pneumonia is defined as pneumonia that develops in an intubated patient after 48 hours or more of mechanical ventilator support as assessed by the Clinical Pulmonary Infection Score $\geq$ 6.

HYPOTHESIS:

There is a significant difference in the occurrence of Ventilator Associated Pneumonia between the patients who receive modified oral care protocol with subglottic suctioning and those who receive routine care.

ASSUMPTION:

Patients who are intubated and mechanically ventilated are prone to get Ventilator Associated Pneumonia.

CONCEPTUAL FRAMEWORK

Conceptual framework for this study was developed on the basis of Orem's Self-Care Deficit theory, which is the basic element of Orem's general theory of nursing. This was developed by Dorothe E. Orem (1990).

According to Orem nursing care is needed when adults are incapable of or limited in ability to perform effective self care on their own. When the self-care abilities are less than those required for meeting self-care demand, nursing agency takes the role of meeting the self care need. Nursing agency helps the individual to incorporate newly prescribed, complex self-care measures into their self care systems or to recover from disease or injury, which requires specialized knowledge and skills. Orem identified five methods by which the nursing agency helps the individual to meet their self-care needs, as acting for or doing for another, guiding and directing, providing physical or psychological support, providing and maintaining an environment that supports personal development and teaching. The nurse designs the nursing system based on an individual's self-care needs and his ability to perform the self-care. Whenever there is a lack of individual's ability to do self care, self-care deficit exists and the need for nursing arises.

SELF-CARE

Self -care is a group of activities which comprise those activities performed independently by an individual to promote and maintain personal well-being throughout life.

SELF-CARE AGENCY

Self-Care agency is the individual's ability to perform self-Care activities. There are two agents providing self-care, the self-care agent and dependent care agent.

SELF-CARE DEMAND

Therapeutic self-care demand refers to those activities required to meet the self-care requisites. It involves the use of actions to maintain health and well being. Whenever self -care demand exceeds the patient's self-care agency, the self-care deficit results.

NURSING AGENCY

Refers to the series of actions taken by the nurse to meet a patient's self-care requisite. Nursing agency acts by three systems namely wholly compensatory, partly compensatory and supportive educative. A wholly compensatory nursing system is used when a patient's self-care agency is so limited that the patient depends on others for well being

The attributes adopted in this study are,

SELF-CARE

Self-care refers to the oral care measures to be carried out by the individual to prevent oropharyngeal colonization of pathogenic bacteria.

SELF-CARE AGENCY

Self-care agent is the individual's ability to do their self care activities. The intubated and mechanically ventilated subjects were unable to perform oral care on their own.

SELF-CARE DEMAND

The self-care activities needed to meet the study subject's oral hygiene are, regular implementation of oral care and preventing the pooling of subglottic secretions above the endotracheal cuff. When there is lack of standardized oral care practices and steps to prevent the aspiration of subglottic secretions, the mechanically ventilated subjects develop Ventilator Associated Pneumonia.

NURSING AGENCY

The mechanically ventilated patients are unable to maintain oral hygiene since they are unconscious or restricted to the bed. Therefore the need of wholly compensatory nursing system arises. The actions taken by the nursing system incorporates the implementation of modified oral care protocol with subglottic suctioning.

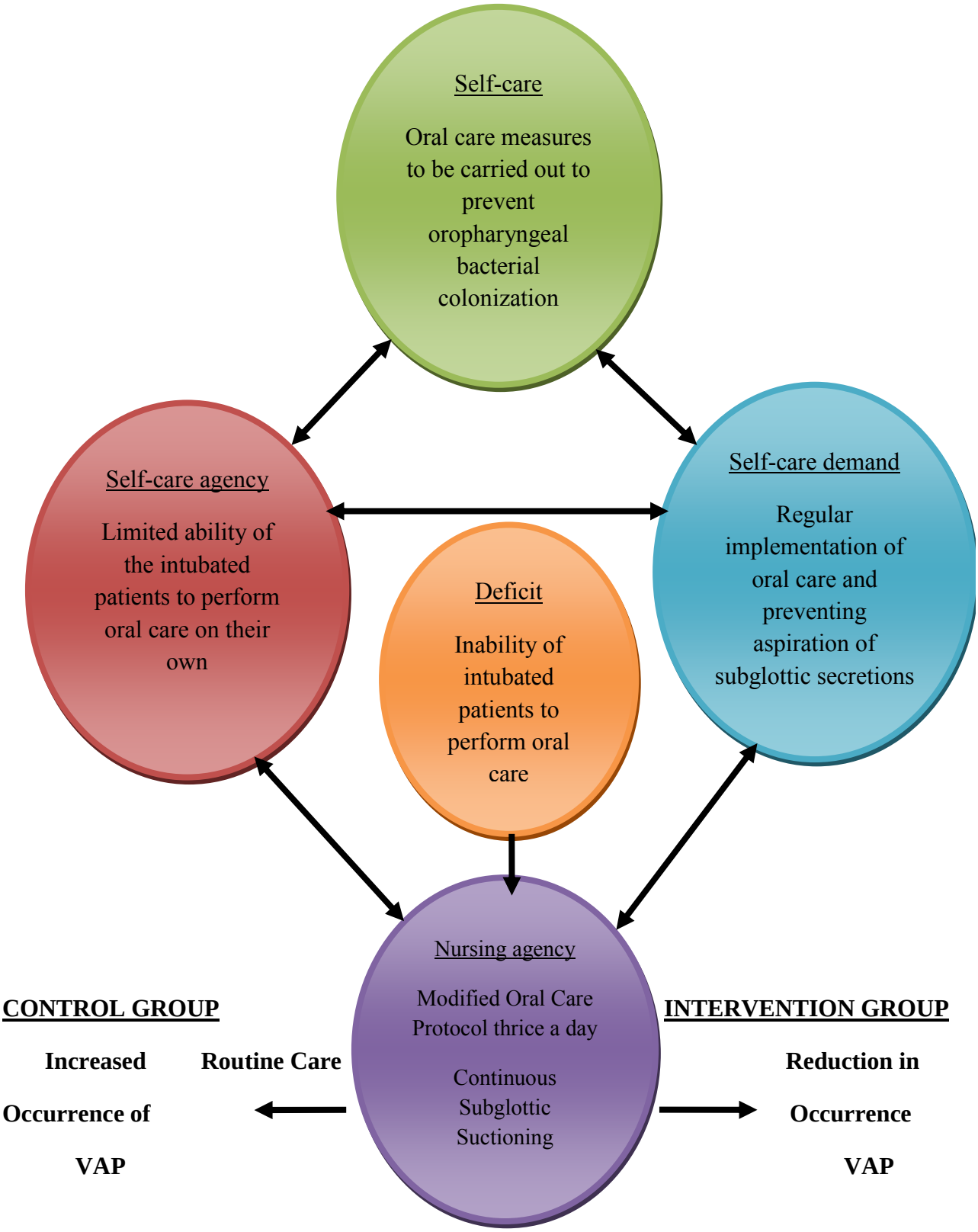


Fig 1: Conceptual framework based on Orem's Self-Care deficit theory (1990).

CHAPTER-II

REVIEW OF LITERATURE

This chapter deals with the information gathered from various research articles and unpublished thesis, related to the present study. Literature review helps the researcher to strengthen the present study by laying a better foundation and also to mould the study for best outcome. The review for the present study is categorized as follows:

(a) Literature related to incidence of VAP

(b) Literature related to the prevention of VAP

(c) Literature related to oral hygiene for intubated clients

(d) Literature related to subglottic suctioning

(a) Literature related to incidence of VAP:

Palmore et al. (2010) reported that Health care associated infections (HAI) are significant contributors to unnecessary morbidity associated with healthcare delivery in the United States, placing the field of healthcare epidemiology under intense scrutiny. The Centers for Disease Control and Prevention (CDC) noted that 1.7 million HAI and nearly 99,000 deaths reported in U.S. hospitals in 2002, which exceed the number of deaths from any common disease. CDC epidemiologists estimated that 36.3% of these deaths were associated with pneumonia, mainly hospital acquired. The U.S. Government Accountability Office has kept HAI among the top 10 causes of death in the United States. Ventilator Associated Pneumonia (VAP) is a major clinical problem for critically ill and immunocompromised patients since they require higher antibiotics, increased length of stay, and increased mortality. A substantial portion of patients who die while hospitalized in intensive care units die with, if not of, VAP.

(b) Literature related to the prevention of VAP:

Establishment of an artificial airway increases the risk of contamination of the respiratory tract of critically ill and often immunocompromised intensive care unit patients. Subsequent colonization may lead to ventilator associated pneumonia, a feared and common complication in the ICU setting. Prevention of VAP is extremely important because of its worsening consequences. Preventive measures include but not restricted to, early Weaning, Hand hygiene, Aspiration precautions, and Prevention of contamination (WHAP). It has proven that an

educational initiative on WHAP, directed at respiratory care practitioners and intensive unit nurses, was associated with decreases in VAP incidence rates of up to 61% (Schultz et.al. 2010).

Prevention of VAP is a multifaceted priority of the intensive care team. Introduction of specialized artificial airways is a milestone in evolving technologies in preventing VAP. Substantial evidence suggests that the use of endotracheal tube with a dorsal subglottic lumen, silver – coated and antiseptic – impregnated endotracheal tubes reduces the incidence of VAP by 50% (Gentile et al. (2010).

Omrane et.al. (2007) contributed that the implementation of several clinical practices in preventing VAP has not gained widespread acceptance. A pre- and post intervention observational study was conducted to study the impact of a protocol incorporated with evidence based interventions, in reducing the frequency and overall rate of VAP. Mechanically ventilated patients in Montreal General Hospital for duration of one year were included. A multidisciplinary prevention protocol was developed and implemented for all patients. Rate of VAP per 1000 ventilator days were calculated before and after the implementation of the multidisciplinary prevention protocol. Results showed 23 VAP episodes in 925 ventilator-days during pre-interventional period and decreased to 22 episodes in 988 ventilator-days during post intervention period ($p = 0.001$). Implementing a VAP prevention protocol incorporated with evidence based guidelines reduced the crude incidence of VAP including early and late onset VAP.

Blot et al. (2007) assessed the knowledge of intensive care unit nurses on evidence based guidelines for the prevention of VAP using a validated multiple choice questionnaire. Among 638 respondents 19% recognized oral intubation as the recommended way for intubation; 49% suggested changing the ventilator circuit for each new patient; 60% respondents recognized subglottic drainage is known to prevent VAP by 90%. As a whole nurses lack knowledge regarding recommendations for VAP prevention.

Strategies to prevent VAP could be better developed only if a sound understanding of pathogenisis and epidemiology exists. The major route for acquiring VAP seemed to be the endogenous flora or by pathogens acquired exogenously from ICU environment (hands or apparel of health team members, contaminated respiratory equipment, hospital water, or air). Apart from that stomach represents a potential site of secondary colonization and reservoir of nosocomial Gram-negative bacilli. Biofilm formation in endotracheal tube contributes to tracheal

colonization and lead to late-onset VAP, after seven days of intubation. Endemic VAP results from aspiration of oropharyngeal, gastric and tracheal secretions around cuffed endotracheal tubes into the sterile respiratory tract. Strategies to prevent endemic VAP include oral care, prophylactic aerosolization of antimicrobials, selective aerodigestive mucosal antimicrobial decontamination, stress ulcer prophylaxis and measures to prevent aspiration (VAP bundle with subglottic suctioning). Epidemic VAP incidence could be zeroed if rigorous disinfection of respiratory equipments and bronchoscopes, and infection control measures were followed strictly. (Safdar, 2005).

(c) Literature related to the importance of oral hygiene for intubated patients:

Garcia et al. (2009) determined the effect of a comprehensive oral and dental care protocol on the rate of VAP by pre-post interventional study. Adults' receiving mechanical ventilation more than 48 hours in Brookdale University Hospital was studied in a two consecutive 24-month periods. Pre-interventional group (n = 779) had no oral assessments, no subglottic suctioning, no tooth brushing, and suctioning of secretions in oral cavity as needed. The interventional group (n = 759) was treated with a protocol which included oral assessment, deep suctioning every 6 hours, oral tissue cleansing every 4 hours or as needed and tooth brushing twice daily. VAP rate was determined using Clinical Pulmonary Infection Score (CPIS) (CPIS > 6). The rate of VAP was found to be 12% per 1000 ventilator days before the intervention and decreased to 8.0% per 1000 ventilator days during the intervention (p = 0.06). Researcher concluded that the implementation of comprehensive oral care protocol and staff compliance significantly reduced the VAP rate and its associated costs.

Grap et al. (2009) conducted a survey on oral care interventions in critical care. Patient's oral care is a key component of nursing care. Oral care is often considered primarily an intervention for patient's comfort which may reduce its priority and frequency. Oropharyngeal colonization is associated with several systemic diseases, including cardiovascular disease, chronic obstructive pulmonary disease, and in ICU Ventilator Associated Pneumonia (VAP). VAP occurs in 9% to 24% of patients with various pulmonary disorders. The mortality rate of VAP varies from 54% and 71% and mortality is particularly high in pneumonia attributed to pseudomonas or acinetobacter. Dental plaque colonized with microbes serve as a reservoir for pathogens in patients with poor oral hygiene. Tooth brushing is effective in reducing number of oral microbes, but it is not routinely performed in ICUs. The lack of published protocols for oral

care in intubated clients seems to be the reason. This project described oral care interventions reported by nurses and showed how often these interventions were documented in medical records. The subjects surveyed include 170 nursing care providers and all critically ill patients above 18 years for a period of one month. 75% of respondents reported providing oral care 2 to 3 times per day for non intubated and 72% reported providing oral care more than 5 times per day for intubated patients. Reported use of toothbrush ($p<.001$) for non intubated patients was significantly greater than intubated patients. ICU nurses might be hesitant to provide oral care to intubated patients because ET tubes may limit access to the oral cavity and the fear of tube displacement. These problems can be solved by using a pediatric toothbrush with soft bristles.

A quality improvement project was implemented in Critical Care Units of Springfield medical center based on the findings that VAP develops at a rate of 1% to 3% per day of mechanical ventilation. Mechanically ventilated patients included in the study received the modified oral care protocol every 4 hours: tooth brushing with povidine iodine solution using a suction toothbrush, cleansing oral cavity with hydrogen per-oxide swabs, application of a moisturizer and deep oropharyngeal suctioning. The primary efficiency variable, VAP was diagnosed using Clinical Pulmonary Infection Score > 6 after 48 hours of mechanical ventilation. The historical average rate of VAP in 2004 was 12.6 cases per 1000 ventilator days, which was reduced to 4.12 in December 2005, to 3.57 for 2006 and to 1.3 for 2007, after the inception of the quality improvement project. The introduction of a modified oral care protocol with ventilator bundle led to an 89.7% reduction in VAP rate from 2004 to 2007 (Hutchins et al. 2009).

Munro et al. (2009) conducted a study to evaluate the effects of mechanical (toothbrushing), pharmacological (topical chlorhexidine), and combination oral care (toothbrushing plus chlorhexidine) in reducing the VAP rate using randomized controlled clinical trial with a 2×2 factorial design. He enrolled 249 intubated patients within 24 hours of intubation from three ICUs. Patients with clinical diagnosis of pneumonia at the time admission were excluded. Patients were randomized to one of the four treatment groups, 0.12% chlorhexidine swab twice daily, tooth brushing thrice daily, both tooth brushing and chlorhexidine, and usual care. Data were collected using Clinical Pulmonary Infection Score (CPIS). Results proved that chlorhexidine in combination with tooth brushing significantly reduced the incidence of VAP (CPIS <6) by day 3.

Sona et al. (2009) conducted a pre-post intervention observational study to determine the effect of a simple low-cost oral care protocol on VAP rate, in 24 bedded Surgical ICU of Barnes-Jewish Hospital, Missouri. All mechanically ventilated patients for a time period of one year were enrolled in the study. The oral care protocol involved tooth brushing and subsequent application 0.12% Chlorhexidine gluconate twice daily in 12 hours interval. During pre-intervention period there was 24 infections in 4606 ventilator days (rate = 5.2 infections per 1000 ventilator days). There was a reduction in the incidence of infection to 10 in 4158 ventilator days resulting in a lower rate of 2.4 per 1000 ventilator days. There was a statistical significance in this 46% reduction of VAP ($p = 0.04$). The fewer cases of VAP led to a decrease in cost of US$140,000 to US$560,000 based on estimated cost per case of VAP. There was a overall reduction of VAP rate by implementation of a low-cost oral care protocol.

Fields et al. (2008) reported that mechanically ventilated patients in neurologic and other intensive care units are at an increased risk of VAP due to decreased level of consciousness; dry open mouth; and micro aspiration of secretions. VAP can be prevented by initiating interventions from the institute of Healthcare Improvement's (IHI) VAP bundle including elevating the head end of bed to 30^0 , DVT prophylaxis, gastric ulcer prophylaxis, early mobilization, and sedation holidays. The one intervention not included in IHI bundle is oral hygiene. This project aimed at timed tooth brushing combined with VAP bundle in mitigating and preventing the occurrence of VAP. A randomized controlled trial was initiated on a 24-bed ICU with stroke patients. Nurses were instructed about the importance of oral care and how to do it using a toothbrush with soft bristles. The protocol includes using a toothpaste, toothette, application of a moisturizing agent every 4 hrs, oral and pharyngeal suctioning with an enclosed Yankauer suction catheter, which was disposed of every 24 hrs, and inspection of oral cavity every 24 hrs. The results were startling, as the VAP rate dropped to zero within a week of beginning the every-8-hours tooth brushing regimen in the intervention group. The study was so successful that the control group was dropped after 6 months, and all intubated patients were brushed every 8 hours.

Tsai et al. (2008) performed a prospective evaluation of usefulness of intermittent suctioning of oral secretions before each position change in reducing VAP. A time-sequence non randomized intervention design was used. After a duration of 9 month observation phase and 6 month education phase, followed by a 7 month intervention phase the occurrence of VAP rate was reduced in studied group (6 of 227 patients, 2.6%) than control group (26 of 237 patients,

11%) ($p < 0.001$). The incidence of VAP in control and study group was 6.51 and 2.04 per 1000 ventilator days respectively ($p = 0.002$). Thus intermittent suction of oral secretions before each position change proved to be effective in reducing VAP.

Berry et al. (2007) proposed oral hygiene as a key intervention for reducing ventilator associated pneumonia. In his study Berry recognized oral hygiene in combination with subglottic suctioning reduces the incidence of VAP from 28% to 9%. The use of preferable oral hygienic practices by nurses should be changed to standardized protocols. The use of a flexible suction catheter during oropharyngeal suctioning reduces the incidence of aspiration.

(d) Literature related to subglottic suctioning:

Lacherade et al. (2010) determined the effect of Subglottic Secretion Drainage (SSD) in reducing the incidence of microbiologically confirmed VAP. Patients of four French hospital ICUs, were enrolled in a randomized clinical trial. Among 333 patients 169 were assigned to experimental group, receiving intermittent SSD and 164 in control group not receiving SSD. Occurrence of VAP, using distal pulmonary sampling confirmed VAP in 67 patients, 25 (14.8%) of interventional and 42 (25.6%) of control group ($p = 0.02$). The relative risk reduction was 42.2%. Statistically the incidence of both early (1.2% in interventional and 6.2% in control group [$p = 0.02$]), as well as late onset VAP (18.6% in interventional and 33.0% in control group [$p = 0.01$]) were reduced by administering SSD. The influence of SSD in reducing VAP had been proved.

Bouza et al. (2008) compared conventional and continuous aspiration of subglottic secretions (CASS) procedure in reducing VAP. A population of 714 patients was randomized as, 331 in control group and 359 in CASS group. In mechanically ventilated patients > 48 hours the VAP incidence was 26.7% in CASS group and 47.5% in control group ($p = 0.04$); incidence density, 31.5 Vs 51.6 episodes per 1000 days of mechanical ventilation respectively ($p = 0.03$); median length of ICU stay, 7 Vs 16.5 days ($p = 0.01$) respectively. The study was concluded as CASS is a safe procedure that reduces the use of antibiotics and incidence of VAP in at risk patients and no complications related to CASS were observed.

Depew et al. (2007) reported VAP as a costly complication of hospitalization that lengthens ICU stay, increasing morbidity and mortality. Use of a specialized endotracheal tube with an aspiration port that aspirates subglottic secretions reduces the micro aspiration of colonized secretions into lower airways. Recommendations for VAP prevention by the Centers

for Disease Control and Prevention, describes subglottic suction drainage as a key intervention. Further projects on cost effectiveness, complications during subglottic secretion drainage, and major issues in implementing the use of an endotracheal tube with subglottic port need to be documented.

Aspiration of subglottic secretions plays a major role in the development of VAP with a mortality rate up to 71%. The focus of this study was to find out the optimal suction pressure levels needed to efficiently evacuate subglottic secretions. The effectiveness of suction pressures (20 mm of Hg, 30 mm of Hg, 40 mm of Hg and 50 mm of Hg) needed to maximize evacuation efficiency based on volume and viscosity of subglottic secretions (2ml, 4ml, and 6ml) was studied. The results showed that thick secretions had the highest percentage of evacuation efficiency (86%) and the suction pressure of 30 mmHg had the highest overall mean of secretion recovery (83%). Thus the study demonstrated that highly viscous secretions are easier to evacuate when the suction pressure applied was 30 mmHg. Removal of subglottic secretions irrespective of its viscosity and amount assist in delaying the development of VAP. O'Neal et al. (2007).

Smulders et al. (2002) studied the effect of subglottic secretion drainage on the incidence of VAP in mechanically ventilated patients. A randomized clinical trial was used in a 12 bedded general ICU. 150 patients receiving mechanical ventilation > 72 hours were randomized equally to experimental and control group. Homogeneity was maintained in both groups with respect to demographic characteristics and severity of illness. Experimental group were intubated with an endotracheal tube with intermittent subglottic drainage port and control group were intubated with a standard endotracheal tube. The outcome variables measured by the researcher were the incidence of VAP, duration of mechanical ventilation, length of ICU and hospital stay and mortality. Using Clinical Pulmonary Infection Score (CPIS) VAP rate was diagnosed to be 4% in experimental group and 16% in control group ($p = 0.014$) and other outcomes were not significant. Intermittent subglottic drainage proved to be effective in reducing VAP incidence in mechanically ventilated patients.

Shorr et al. (2001) determined the cost effectiveness of continuous subglottic suctioning (CSS) as a strategy to decrease the incidence of VAP. Decision-model analysis of the cost and efficiency of CSS endotracheal tubes in preventing VAP was used. Estimated models were based on the data from published prospective trials of CSS and prospective studies of VAP.

Hypothetical cohort of 100 patients requiring nonelective intubation in ICU was the inclusion criteria. The calculated marginal cost effectiveness of CSS was the savings resulting from cases of VAP averted minus additional cost of CSS-ETs, and expressed as cost per episode of VAP prevented. Despite higher cost of CSS-ETs, a net savings of $4,992 was achieved resulting in $1,924 savings per case of VAP prevented. Thereby CSS continued to be a better cost effective strategy for VAP prevention.

Kollef et al. (1999) conducted a randomized clinical trial of continuous aspiration of subglottic secretions (CASS) in 343 cardiac surgery patients in cardiothoracic ICU of Barnes-Jewish Hospital, St. Louis. Patients were randomized to receive either CASS or routine postoperative medical care without CASS. Homogeneity maintained in case of demographic characteristics, surgery performed and severity of illness. Results showed the occurrence of VAP in eight patients (5%) of experimental group and 15 patients (8.2%) of control group (relative risk, 0.61%; 95% confidence interval, 0.27 to 1.40; $p = 0.238$). Study findings suggested that VAP occurred statistically latter among patients who received CASS ([mean +/- SD] 5.6 +/- 2.3 days) than those who did not receive CASS (2.9 +/- 1.2 days); ($p = 0.006$). CASS can be safely administered without any complications and also effective in preventing VAP.

Valles et al. (1995) conducted a randomized controlled trial in medical and surgical intensive care units with 190 patients for duration of six months. The research design used was a randomized controlled, blinded study. Among 190 patients, 76 were randomly allocated to receive continuous subglottic aspiration in experimental group and 77 in control group to receive usual care. The amount of subglottic secretions was aspirated daily and surveillance cultures obtained. The etiologic diagnosis was based on protected brush specimen and bronchoalveolar lavage. The incidence of VAP was 19.9 episodes/1000 ventilator days in experimental group and 39.6 episodes/1000 ventilator days in control group ($p < 0.03$). Episodes of VAP occurred later in experimental group (12.0 +/- 7.1 days) than in the control patients (5.9 +/- 2.1 days)($p = 0.003$). The microorganisms isolated from protected brush specimen or bronchoalveolar lavage was same as those cultured from subglottic secretions in 85% of cases. So VAP rate could be significantly reduced using aspiration of subglottic secretions.

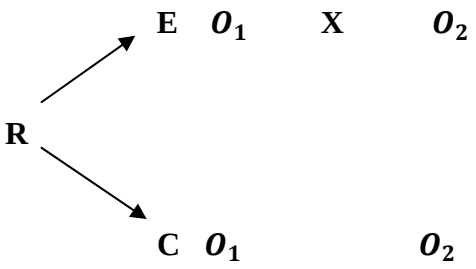
CHAPTER-III

METHODOLOGY

This chapter deals with methodology by which the researcher assessed the Effectiveness of Modified Oral Care Protocol with Subglottic Suctioning in reducing the occurrence of VAP among mechanically ventilated patients. It consists of, research design, variables of the study, setting of the study, population of the study, sample size, sampling technique, criteria for sample selection, randomization, description of the intervention, control, development and description of the tool, validity and reliability, pilot study and procedure for data collection.

RESEARCH DESIGN

The research design for the study is randomized clinical trial, involving manipulation, control and randomization. To specify it is the pre-test and post-test design.



R - Randomization

E - Experimental group

C - Control group

X - Implementation of modified oral care protocol with subglottic suctioning.

O_1 - Pre test assessment of CPIS

O_2 - Post test assessment of CPIS

VARIABLES UNDER THE STUDY

In this study, the modified oral care protocol with subglottic suctioning was the independent variable and the Ventilator Associated Pneumonia was the dependent variable.

SETTING OF THE STUDY

This study was conducted in KMCH Coimbatore. It is a 800 bedded multispecialty hospital, having heart of the state facilities. The Surgical Intensive Care unit is 20 bedded and Medical Intensive Care unit is 14 bedded and well equipped with all modern equipments. On an average about 3-5 patients are newly intubated and mechanically ventilated per day.

POPULATION OF THE STUDY

The population of the study included all the patients who were intubated orally and mechanically ventilated in Surgical and Medical Intensive care units of KMCH, Coimbatore.

SAMPLE SIZE

The sample size was 20, 10 in experimental and 10 in control group.

SAMPLING TECHNIQUE

Non Probability convenient sampling technique was used for sample selection.

CRITERIA FOR SAMPLE SELECTION

Inclusion criteria:

- Patients who need mechanical ventilation
- Critically ill patients with any medical and surgical problems.
- Both male and female patients, aged 18-65 years
- Patients receiving mechanical ventilation in any mode.
- Both patients receiving and not receiving relaxant and sedation.

Exclusion criteria:

- Patients having CPIS $\geq$ 6 with in 48 hrs of intubation.
- Patients intubated in hospitals other than KMCH.

- Patients for whom frequent oral suctioning was contraindicated.
- Patients with facial injury or fascio maxillary surgeries.

RANDOMIZATION

Simple randomization was carried out by making 20 lots of which 10 were assigned to intervention group and 10 were assigned to control group. The lots were collectively placed in a box. The ICU in charge was asked to take one lot each time. Based on the lot the subjects were then assigned to the experimental or control group. The lot taken once was discarded by the researcher.

DESCRIPTION OF THE INTERVENTION

The patients in experimental group were intubated with a special ET tube with a subglottic suctioning port and received the modified oral care protocol formulated by the researcher along with oropharyngeal suctioning before every position change. The subglottic lumen was connected to the suction apparatus with a minimal pressure of 20 mm of Hg for continuous aspiration of subglottic secretions. The modified oral care protocol was be implemented thrice daily for the patients in experimental group at 6am, 12pm and 6pm till extubation or tracheostomy.

CONTROL

The control group had 10 patients, intubated with normal ET tube and received routine oral care.

DEVELOPMENT AND DESCRIPTION OF THE TOOL

The investigator prepared the tool after going through the related literature and with guidance of experts in the field of nursing and medicine.

The tool for the data collection is structured in 2 parts namely Part-I and Part-II.

PART-I

Consists of two sub sections namely section-A and section-B

SECTION-A

Consists of the background variables, including patient's age and gender.

SECTION-B

Consists of clinical profile which includes diagnosis of patient, indication for intubation, usage of antibiotics, name of antibiotics and their classification, administration of relaxant and sedation with their duration, Glasgow Coma Scale (GCS) and Nasogastric tube feeding

PART-II

Clinical Pulmonary Infection Score (CPIS):

Clinical Pulmonary Infection Score is a standardized tool, developed by Pugin et al. (1991). It is widely used in clinical research and in infection control audits. The CPIS includes six parameters as tracheal secretions, Chest X-ray infiltrates, Temperature, Leucocytes count, Pao_2/Fio_2 and culture. Each parameter is given a scoring of 0, 1, and 2 according to their severity. The maximum score is 12. A score $\geq$ 6 shows the presence of VAP.

VALIDITY AND RELIABILITY OF THE TOOL

CPIS tool found to have a reliability of, r = 0.96 (Metheney et al, 2010). The CPIS had a sensitivity of 93%, a specificity and positive predictive value of 100% (Davis 2006). Content Validity was obtained from experts in the field of nursing and medicine.

PILOT STUDY

The pilot study was conducted in Surgical and Medical Intensive Care units of KMCH, Coimbatore, to ascertain the feasibility of the study. Formal permission was obtained before pilot study. Pilot study had been conducted with 2 patients in each group.

PROCEDURE FOR DATA COLLECTION

Prior to the data collection, necessary permission was obtained from concerned authorities and formal information was given to the in charges of the Surgical and Medical Intensive care units. The main study was conducted for a period of 6 weeks. Ethical clearance was obtained from the ethical committee.

Subjects allocated to intervention group were intubated with special endotracheal tube with subglottic port and those who in control group were intubated with regular endotracheal tube and received routine care. All patients were intubated in KMCH ICU. On the day of intubation the patients were assessed with CPIS. The patients having CPIS less than 6 were selected as study participants. The modified oral care protocol with subglottic suctioning has been implemented to interventional group till extubation or tracheostomy. On the day of extubation or tracheostomy, or during any spike of temperature greater than 102^0 F, the post test CPIS was assessed. The control group received the routine care and CPIS was assessed on the day of admission and during any temperature spike or at the time of extubation or tracheostomy. With the results the occurrence of Ventilator Associated Pneumonia in both experimental and control group was determined.

STATISTICAL ANALYSIS

The data collected were analyzed by means of descriptive and inferential statistics. The background variables, clinical variables and the post test CPIS parameters of both intervention and control group were analyzed using frequency and percentage analysis. The independent‘t’ test was used to compare the effectiveness of Modified Oral Care Protocol with Subglottic Suctioning in reducing the occurrence of VAP between intervention and control group. Paired‘t’ test was used to find the effectiveness of Modified Oral Care Protocol with Subglottic Suctioning within the intervention group.

CHAPTER – IV
DATA ANALYSIS AND INTERPRETATION

This chapter deals with the analysis and interpretation of the data collected to evaluate the Effectiveness of Modified Oral Care Protocol with Subglottic Suctioning in reducing the occurrence of VAP among intubated patients in intensive care units at KMCH, Coimbatore.

The data obtained from 20 patients were organized and analyzed as follows.

ORGANIZATION OF DATA

Descriptive and inferential statistics were used for data analysis. Based on the objectives of the study, the collected data were organized as follows.

Section A: Distribution of patients based on Background Variables

Section B: Distribution of patients according to Clinical Variables

Section C: Description of CPIS Parameters in Intervention and Control Group.

Section D: Comparison of CPIS between Intervention and Control group

Section E: Comparison of occurrence of VAP among intubated Patients in Interventional and Control group

SECTION A

Distribution of subjects based on background Variables

Table 1: Description of subjects according to background Variables **N = 20**

S. No	Background Variables	Intervention Group (10)		Control Group (10)	
		f	(%)	f	(%)
1.	Age in years				
	a) 18-45	6	60	5	50
	b) 46-60	2	20	3	30

	c) 61-80	2	20	2	20
2.	Sex a) Male b) Female	6 4	60 40	9 1	90 10

Table 1 explains the distribution of patients in interventional and control group according to age and sex.

With respect to age, 60% (6) in interventional group and 50% (5) in control group were young adults. This shows about half of the patients in both experimental and control group were young adults.

About 60% (6) of the patients in intervention group and 90% (9) of patients in control group were males and remaining were females.

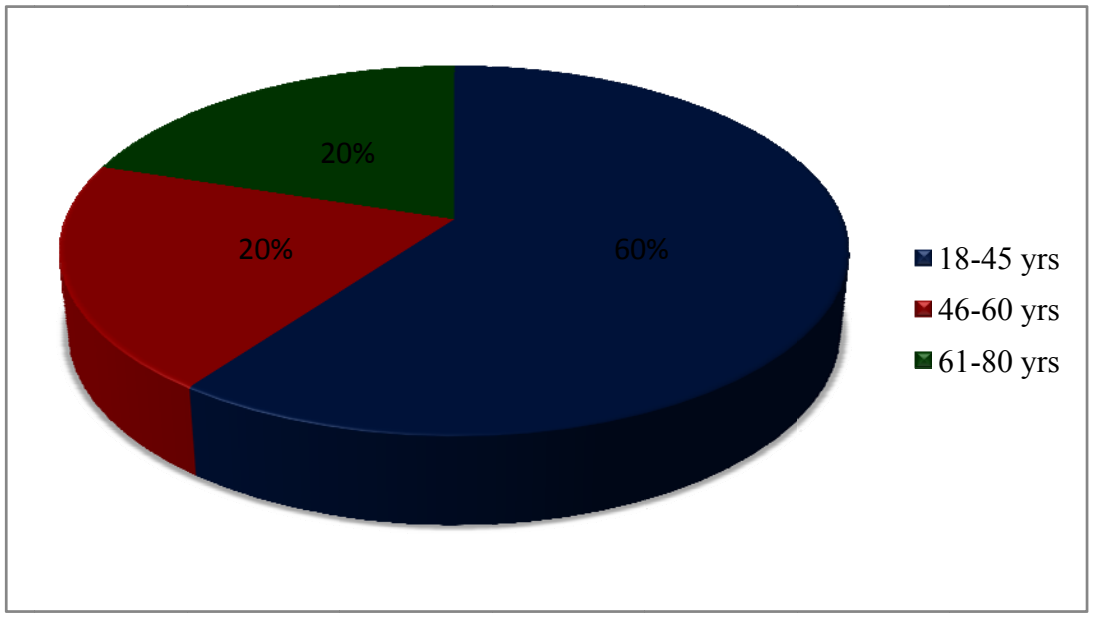


Fig 2: Age wise distribution of subjects in Intervention group

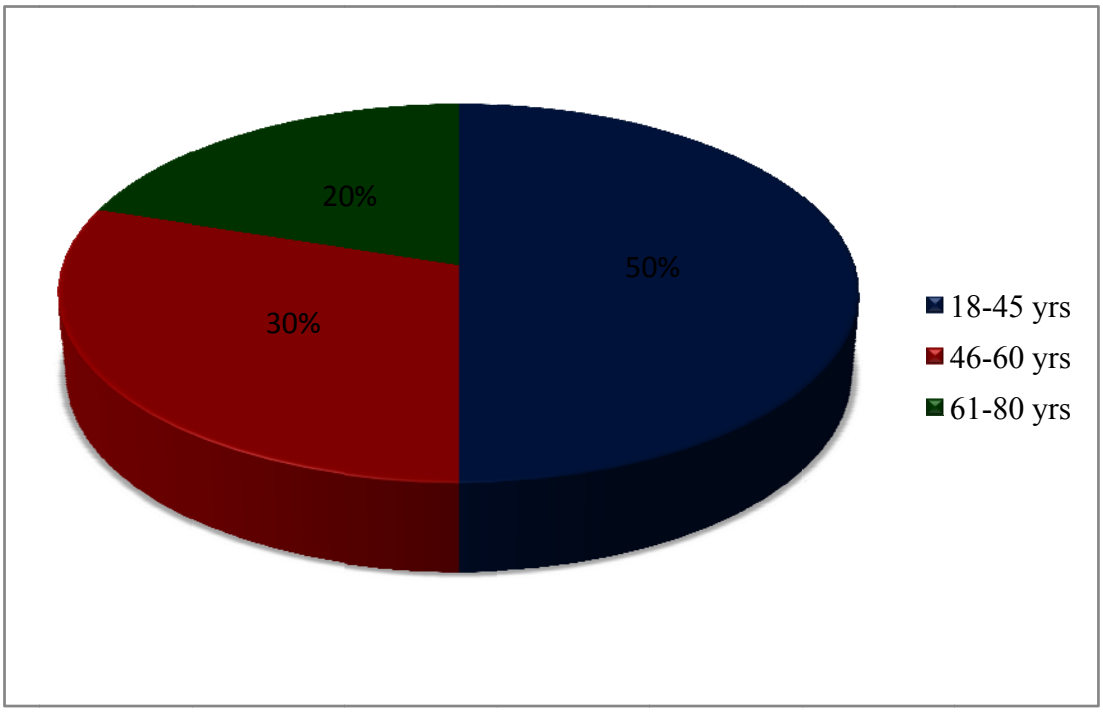


Fig 3: Age wise distribution of subjects in control group

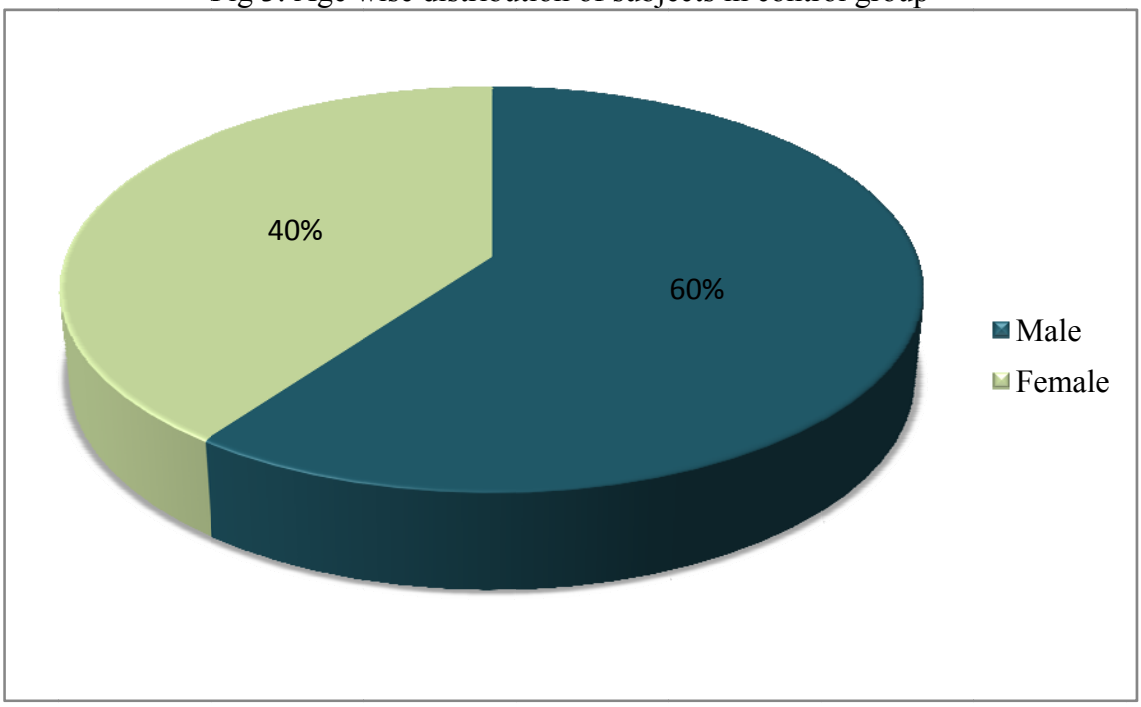


Fig 4: Sex wise distribution of subjects in Intervention group

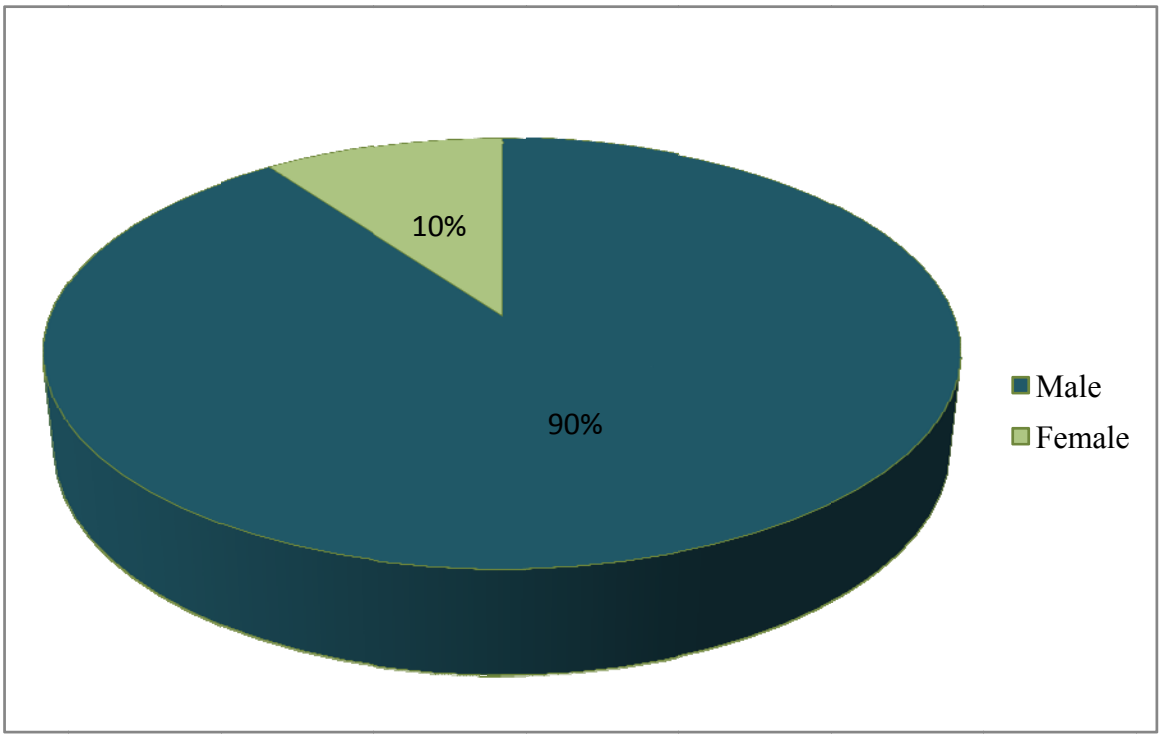


Figure 5: Sex wise distribution of subjects in control group

SECTION B

Distribution of subjects according to Clinical Variables

Table 2: Description of subjects according to Clinical Variables N = 20

S. No	Clinical Variables	Intervention Group (10)		Control Group (10)	
		f	(%)	f	(%)
1.	Diagnosis				
	a) Neurologic disorders	2	20	2	20
	b) Respiratory disorders	0	0		
	c) Cardiovascular diseases	0	0	1	10
	d) Trauma	3	30	3	30
	e) Poisoning	3	30	2	20
	f) Others	2	20	2	20

2.	Reason for Intubation				
	a) Respiratory Failure	2	20	3	30
	b) Airway protection	6	60	4	40
	c) Hemodynamic instability	2	20	3	30
3.	Use of Antibiotics				
	a) Yes	10	100	10	100
	b) No	0	0	0	0
4.	Antibiotics				
	a) Narrow spectrum	7	70	3	30
	b) Broad spectrum	1	10	5	50
	c) Combination	2	20	2	20
5.	Receiving Relaxant and Sedation				
	a) Yes	10	100	10	100
	b) No	0	0	0	0
6.	Duration of Relaxant and Sedation				
	a) Only on the day of intubation	3	30	4	40
	b) Intermittent bolus	5	50	2	20
	c) Continuous infusion	2	20	4	40

7.	GCS				
	a) 13-15	0	0	0	0
	b) 8-12	4	40	5	50
	c) < 8	6	60	5	50
8.	NG Tube Feeding				
	a) Continuous	4	60	7	70
	b) Intermittent	6	40	3	30

Table 2 describes the subjects in intervention and control group according to the clinical variables.

The intervention group and control group had a mix of subjects with varied diagnosis. The common diagnoses were trauma (30%), poisoning (30%), neurologic disorders (20%) and other specific conditions like chronic renal failure and hypoxic encephalopathy respectively in intervention group (20%). There was no patient admitted with respiratory or cardiovascular diseases in intervention group. In control group 30% (3), 20% (2), 20% (2), 10% (1) and 20% (2) were diagnosed as trauma, neurologic disorders, poisoning, cardiovascular disease and other conditions like infected hydronephrosis and chronic liver failure respectively.

Assessing the reason for intubation it was found that majority of the subjects in intervention 60% (6) and control group 40% (4) were intubated for airway protection.

All the subjects in experimental and control group were receiving antibiotics. In intervention group about 70% (7) of the subjects were on narrow spectrum antibiotics but in control group only about 30% (3) of subjects were receiving narrow spectrum. Broad spectrum antibiotic was used in 10% (1) of the intervention group, while 50% (5) of the control groups were on broad spectrum antibiotics. A combination of more than two antibiotics was used in 20% (2) of the intervention and control groups. Among the intervention group 60% (6) received Amoxicillin/Clavulanate Potassium, 20% (2) received a combination of Piperacillin/Tazobactum and Tecoplanin, 10% (1) received Piperacillin/Tazobactum and 10%(1) received cefuroxime. Among the control group 30% (3) received Piperacillin/Tazobactum, 20% (2) received

Meropenum, 20% (2) received ceftriaxone, 10% (1) received cefuroxime and 20% received a combination of Piperacillin/Tazobactum, Tecoplanine and Meropenum.

Considering the GCS of the subjects, 60% (6) in intervention group and 50% (5) in control group were under the score of eight.

About half of the subjects in intervention group (50%), received intermittent bolus of relaxant and sedation, while in control group only 40% received continuous infusion.

Majority of the subjects in intervention group received intermittent feeding, 60% (6) and in control group most of them received continuous feeding, 70% (7).

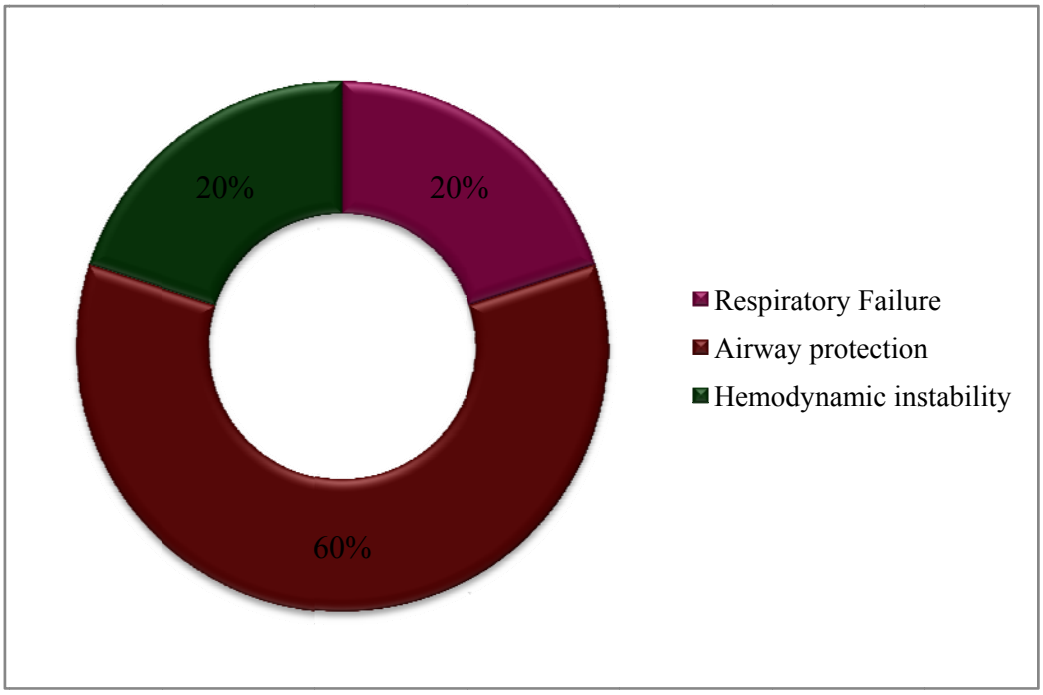


Fig 6: Distribution of subjects based on the Reason for intubation in intervention group

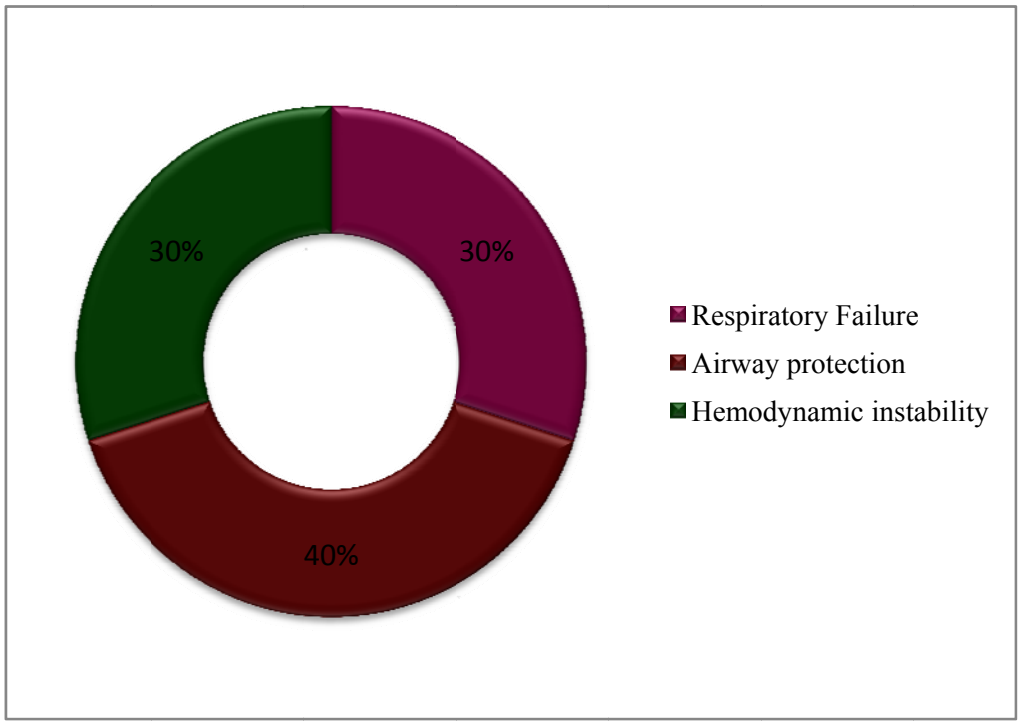


Fig 7: Distribution of subjects based on Reason for intubation in control group

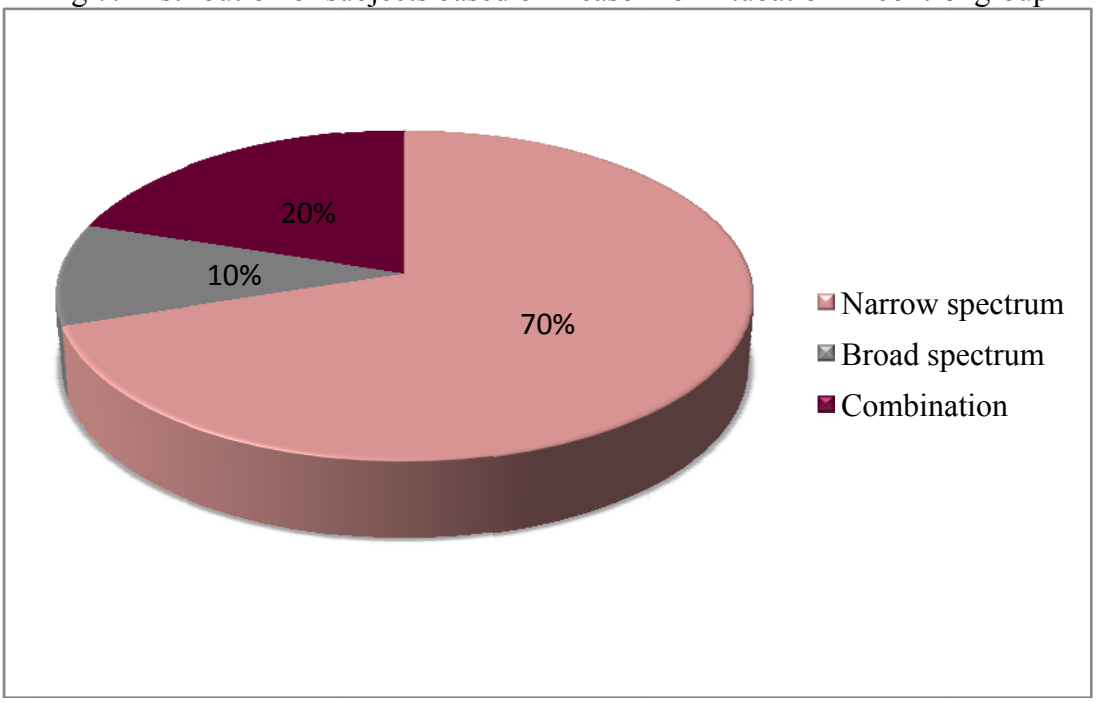


Fig 8: Distribution of subjects based on Antibiotics in interventionl group

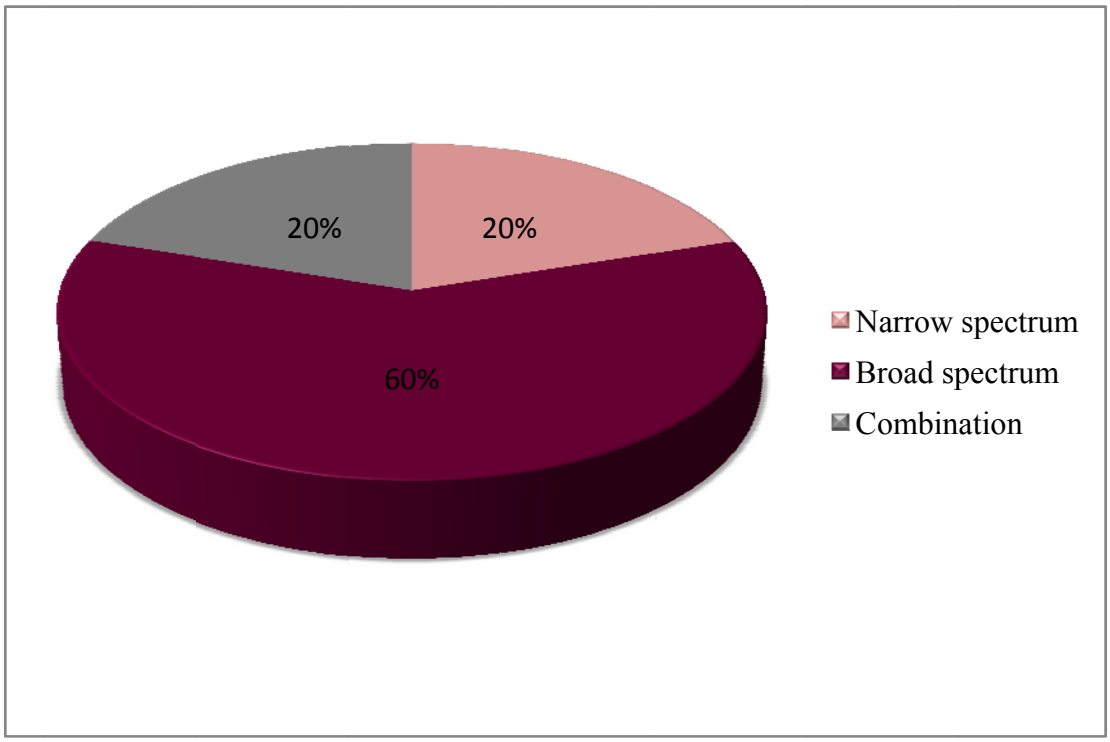


Fig 9: Distribution of subjects based on Antibiotics in control group

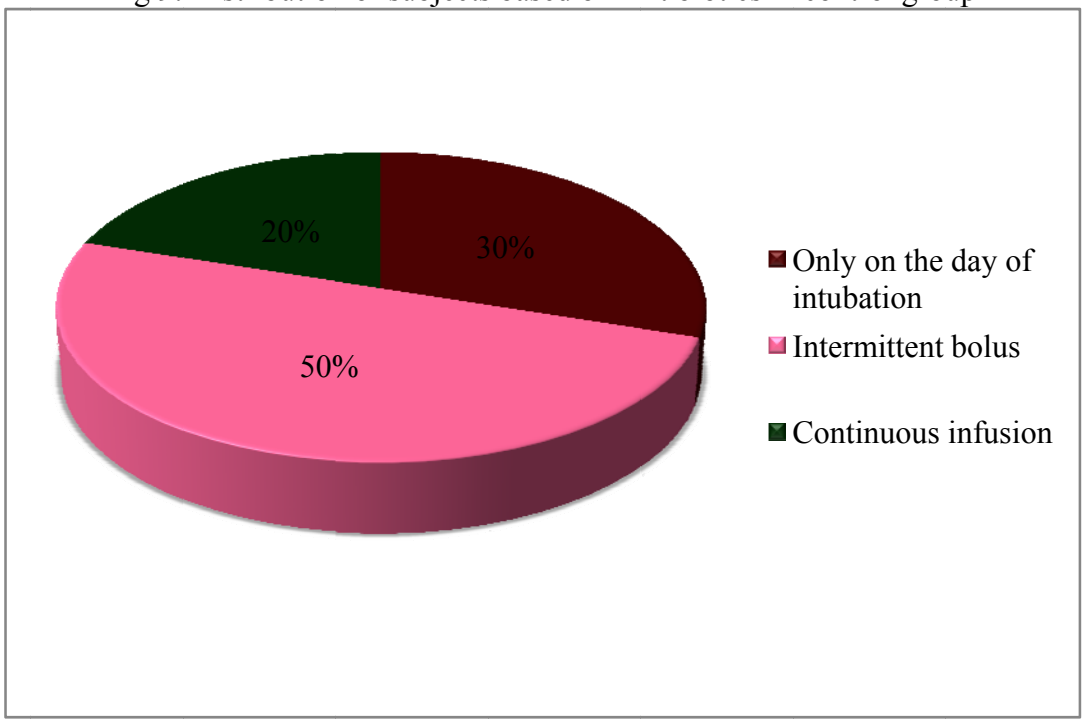


Fig 10: Disribution of subjects based on Duration of relaxant and sedation in intervention group

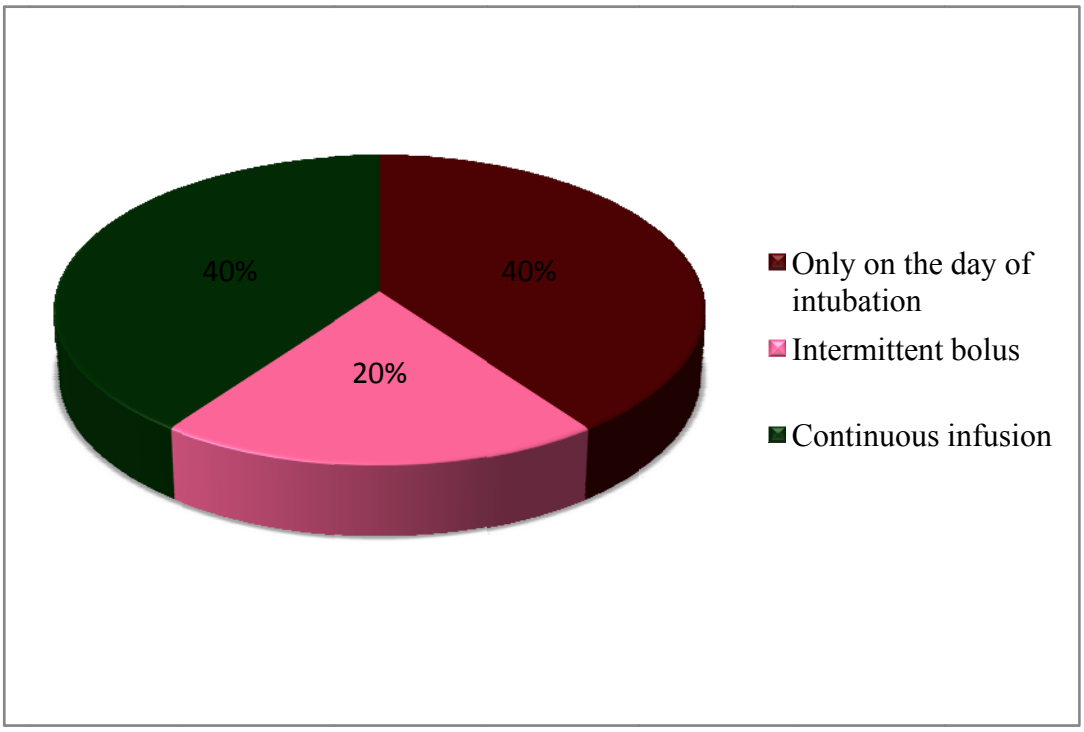


Fig 11: Disribution of subjects based on Duration of relaxant and sedation in control group

SECTION C

Description of Post test CPIS Parameters among intervention and Control group

Table 3: Distribution of Posttest CPIS Parameters in intervention and Control group N=20

S. No	CPIS PARAMETERS	Intervention group		Control group	
		n	%	n	%
1.	Tracheal Secretions				
	a) Rare	3	20	4	40
	b) Abundant	7	70	6	60
	c) Abundant + Purulent	0	10	0	0
2.	Chest X-ray infiltrates				
	a) no infiltrates	6	60	2	20
	b) diffuse	4	40	8	80
	c) localized	0	0	0	0

3.	Temperature in ^{0} C				
	a) ≥ 36.5 to ≤ 38.4	1	10	1	10
	b) ≥ 38.5 to ≤ 38.9	7	70	9	90
	c) ≥ 39 or ≤ 36	2	20	0	0
4.	Leucocytes Count per mm^3				
	a) ≥4,000 to ≤11,000	6	60	4	40
	b) <4,000 or >11,000	4	40	5	50
	c) <4,000 or >11,000 + band forms > 500	0	0	1	10
5.	PaO_2/FiO_2				
	a) >240 or ARDS	10	100	2	20
	b) < 240 and no ARDS	0	0	8	80
6.	Microbiology (culture)				
	a) no growth	6	60	1	10
	b) Pathogenic bacteria cultured > 1	0	0	0	0
	b) Pathogenic bacteria cultured > 1 and same organism seen in gram stain	4	40	9	90

Table 3 illustrates the severity of the six parameters in Clinical Pulmonary Infection Score.

Tracheal secretions were abundant in 70% (7) of the intervention group and 60%(6) of the control group. Majority of patients in intervention group had no chest x-ray infiltrates and 80% (8) of the patients in control group had diffuse infiltrates. 70% (7) of patients in intervention

group and 90% (9) of control group were found to have temperature between 38.5^0c and 38.9^0c. Leucocytes count was normal in 60% (6) of the intervention group and 40% (4) of the control group. None of the patients in intervention group had hypoxemia, but in control group 80% (8) had hypoxemia. There were no pathogenic organisms in the microbiological culture of 60% (6) of the intervention group. In the control group, 90% (9) of the patients had growth of pathogenic bacteria in microbiological report, in which 40% (4) were Pseudomonas Aeruginosa, 20% (2) were Acinetobacter, 20% (2) were candida glabrata and 10% was Klebsiella. In the intervention group the presence of Pseudomonas Aeruginosa was reported in 10% (1) of the patients. A predominant growth of gram negative bacteria in the endotracheal culture of Control group patients was identified.

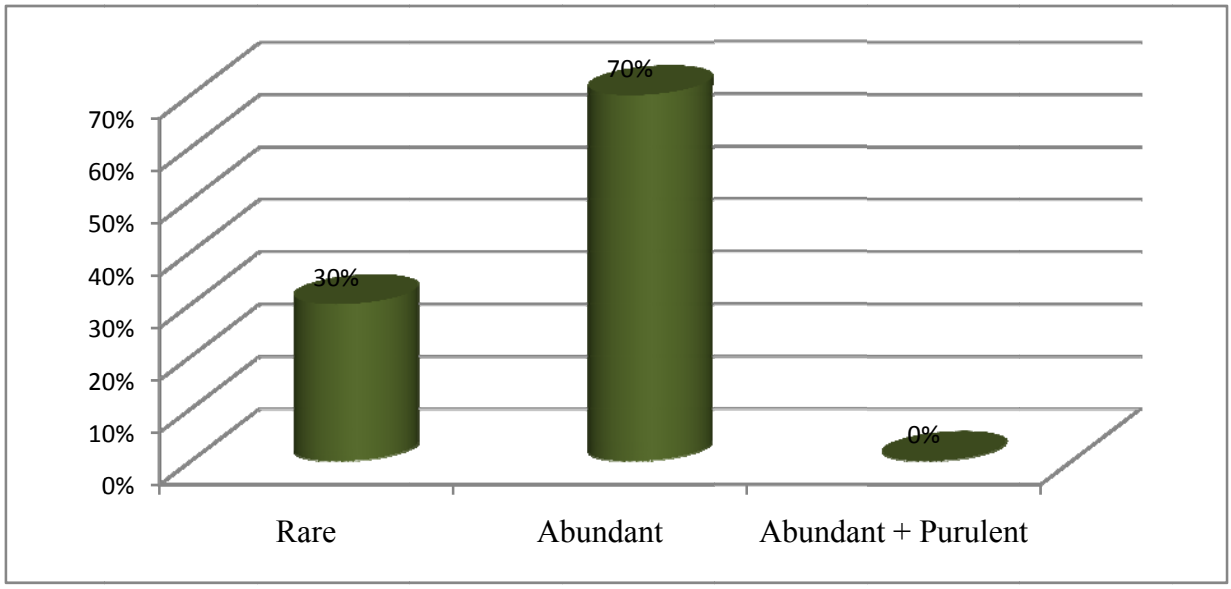


Fig 12: Severity of tracheal secretions in intervention group during post test

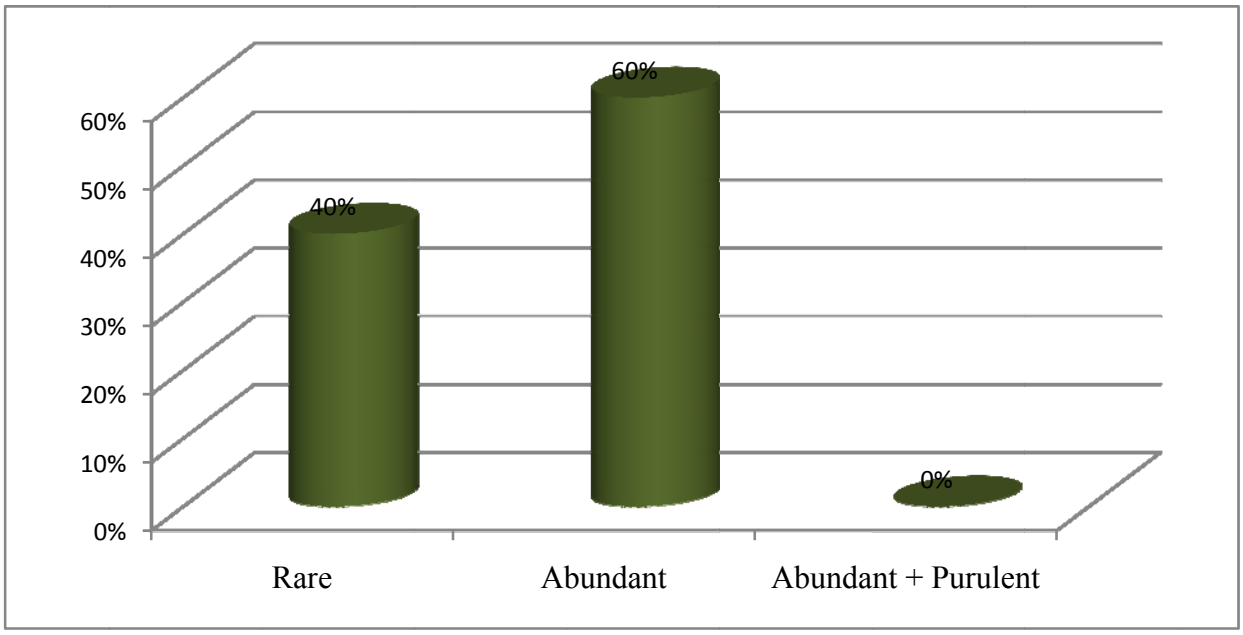


Fig 13: Severity of tracheal secretions in control group during post test

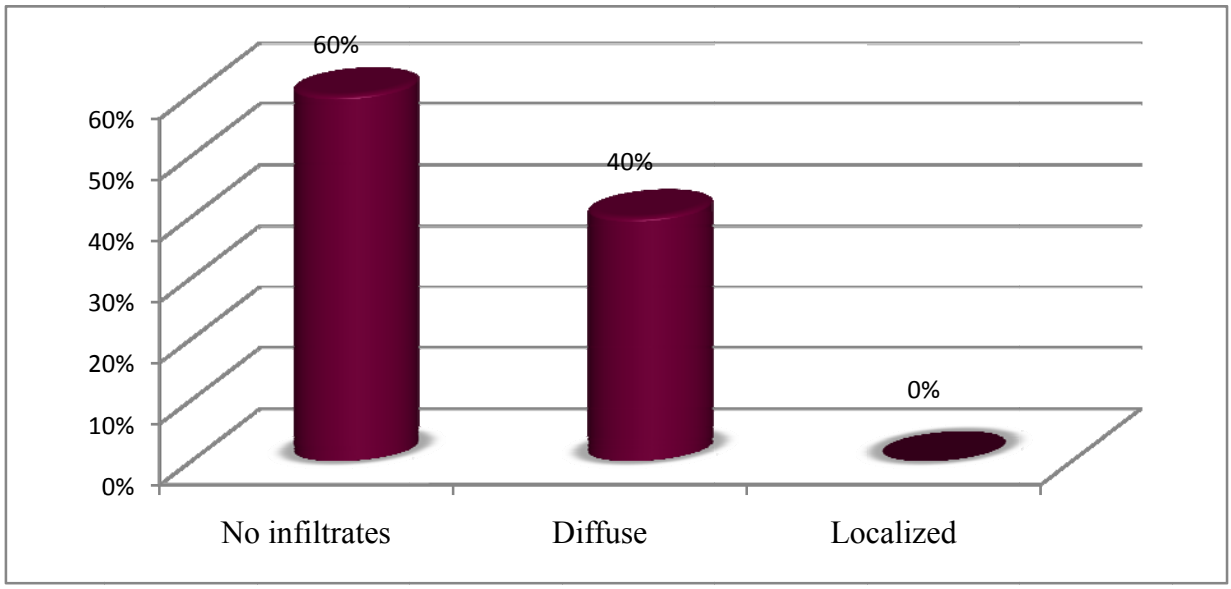


Fig 14: Chest X-ray infiltrates during post test in intervention group

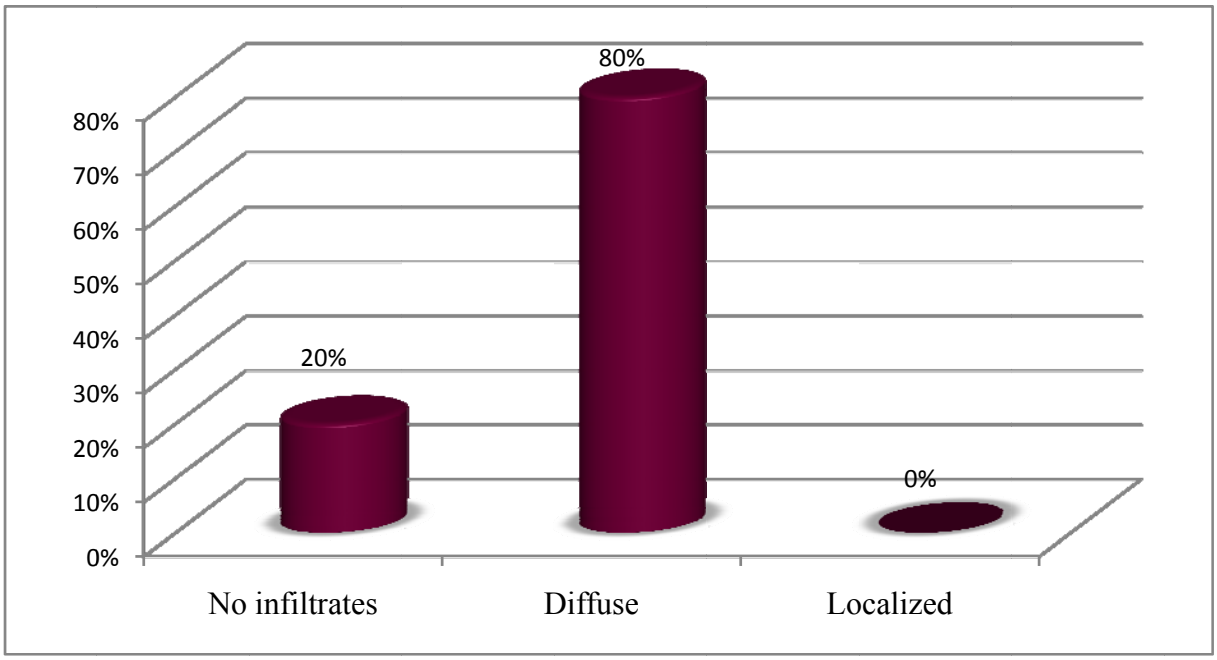


Fig 15: Chest X-ray infiltrates during post test in control group

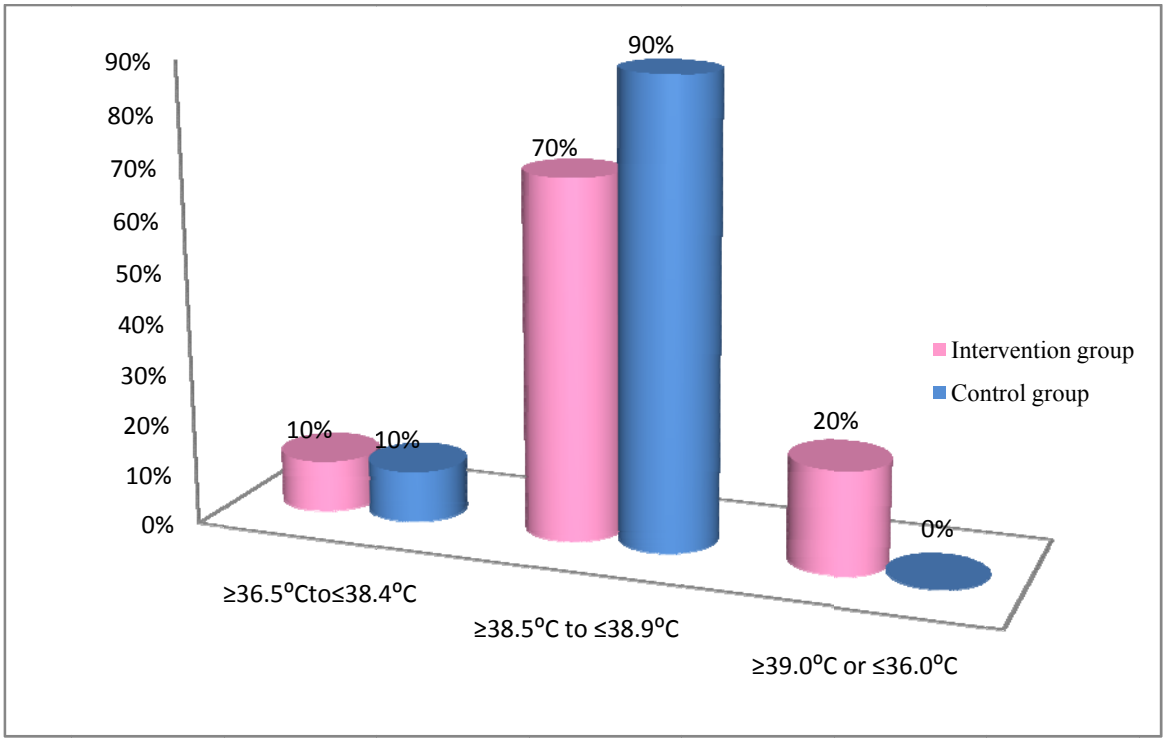


Fig 16: Post test temperature grading in intervention and control group

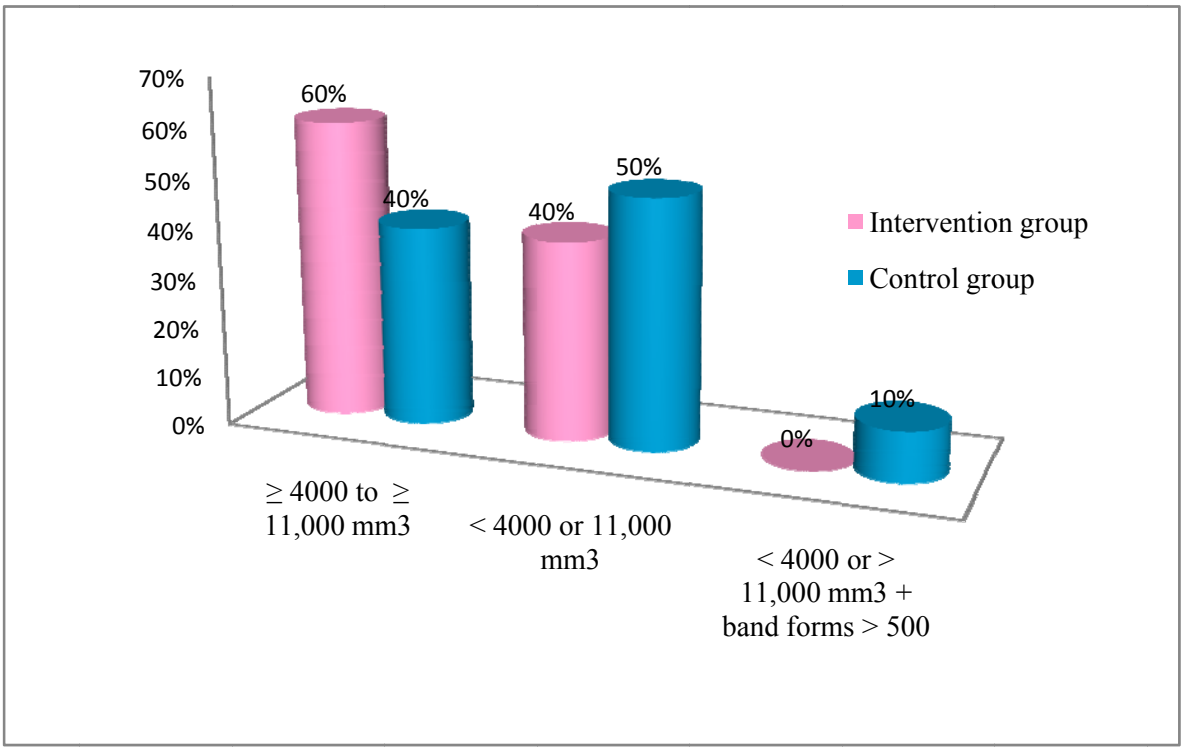


Fig 17: Post test Leucocytes count in intervention and control group

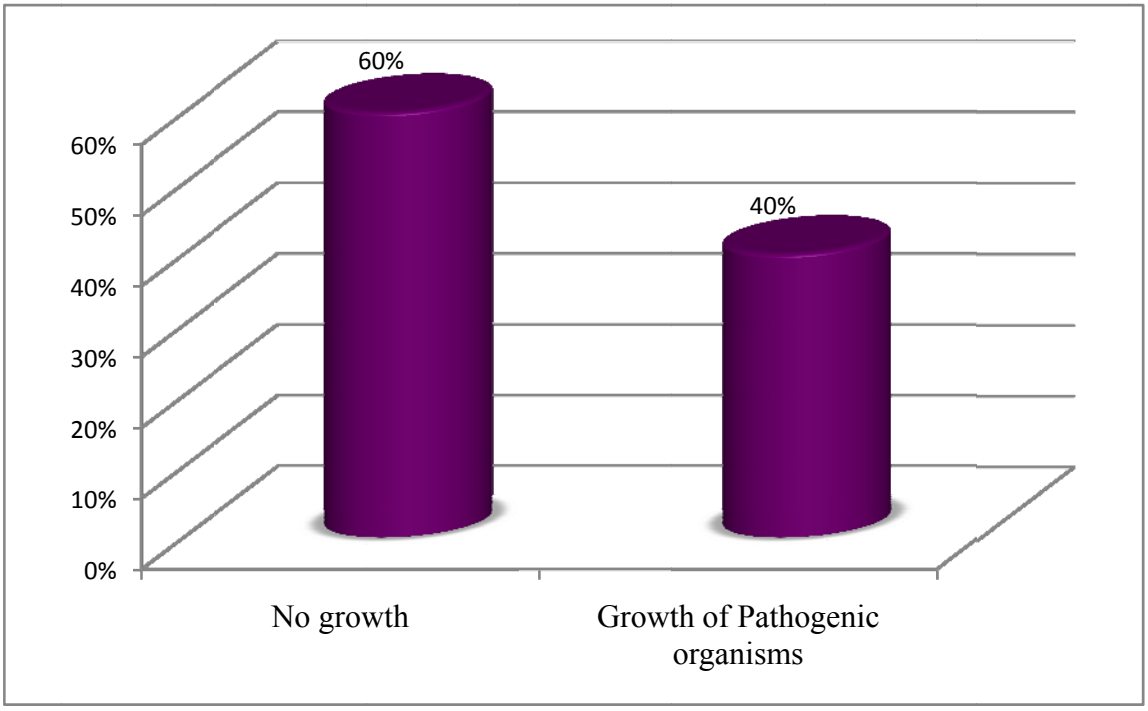


Fig 18: Post test culture report in intervention group

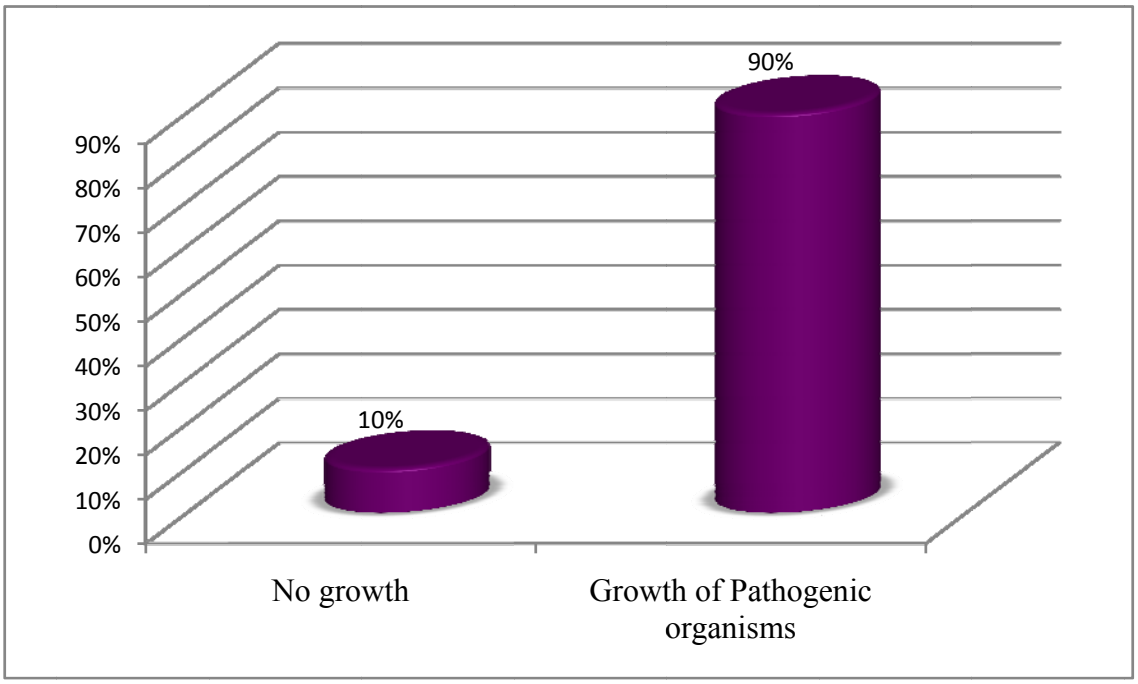


Fig 19: Post test culture report in control group

SECTION D

Comparison of Pre and Post test CPIS in Intervention group

Table 4: Comparison of Pre and Post test CPIS in Intervention group

Intervention group	n	Mean	S.D	Paired 't' Value
Pretest CPIS	10	2.4	0.89	
Posttest CPIS	10	4.1	1.76	5.37*

*P < 0.01

Table 4 depicts that the posttest mean in intervention group is 4.1 which is higher than the pretest mean of 2.4. The't' value for pretest CPIS and posttest CPIS of intubated subjects in intervention group is 5.37, which is significant at 0.01 level. This explains that there is a chance of occurrence of VAP among the intubated subjects in intervention group, because of the interruption of normal physiology due to the presence of endotracheal tube. But there is a

difference in post test value of CPIS between the Intervention and Control group which is discussed in table 5.

Comparison of Pre and Post test CPIS within Control group

Table 5: Comparison of Pre and Post CPIS within Control group

Control Group	n	Mean	S.D	Paired 't' Value
Pretest CPIS	10	2.5	1.76	
Posttest CPIS	10	7.2	2.19	15.80*

*$p < 0.01$

Table 5 confirms that there is a sharp increase in the mean CPIS from 2.5 in the pretest to 7.2 in the post test. The resulting't' value for pretest and posttest CPIS among intubated subjects in control group is 15.80, which is significant at the level of 0.01. This illustrates that there is an increase in the severity of CPIS parameters leading to VAP in posttest of control group.

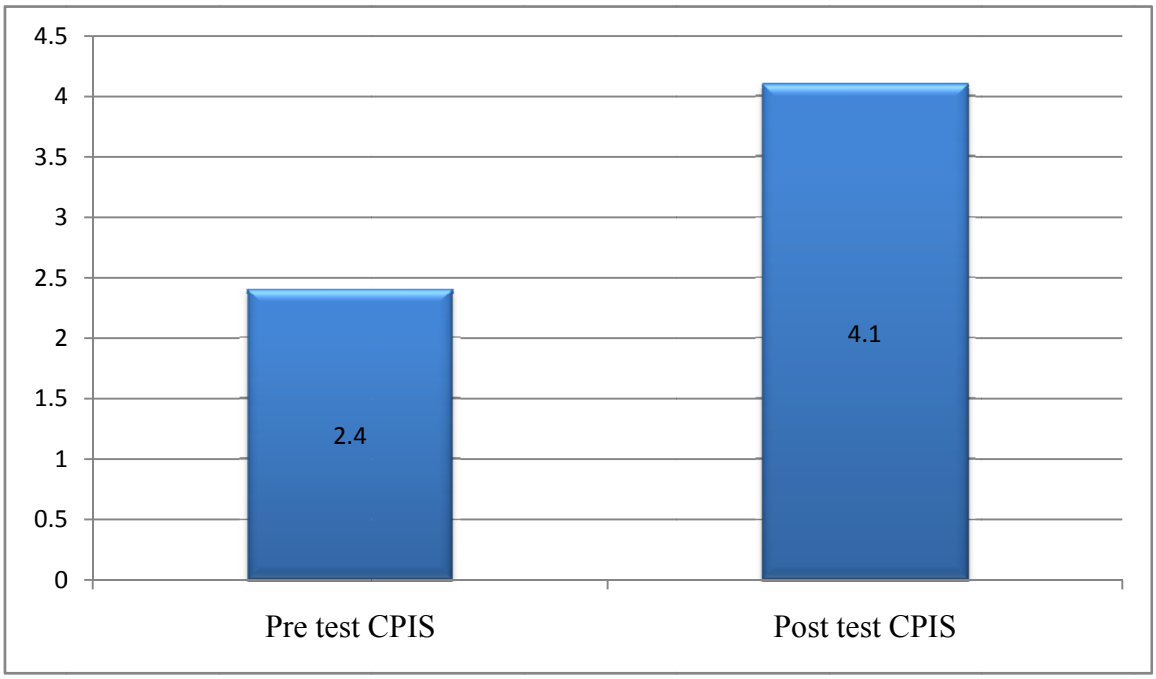


Fig 20: Comparison of pre and post test CPIS in intervention group

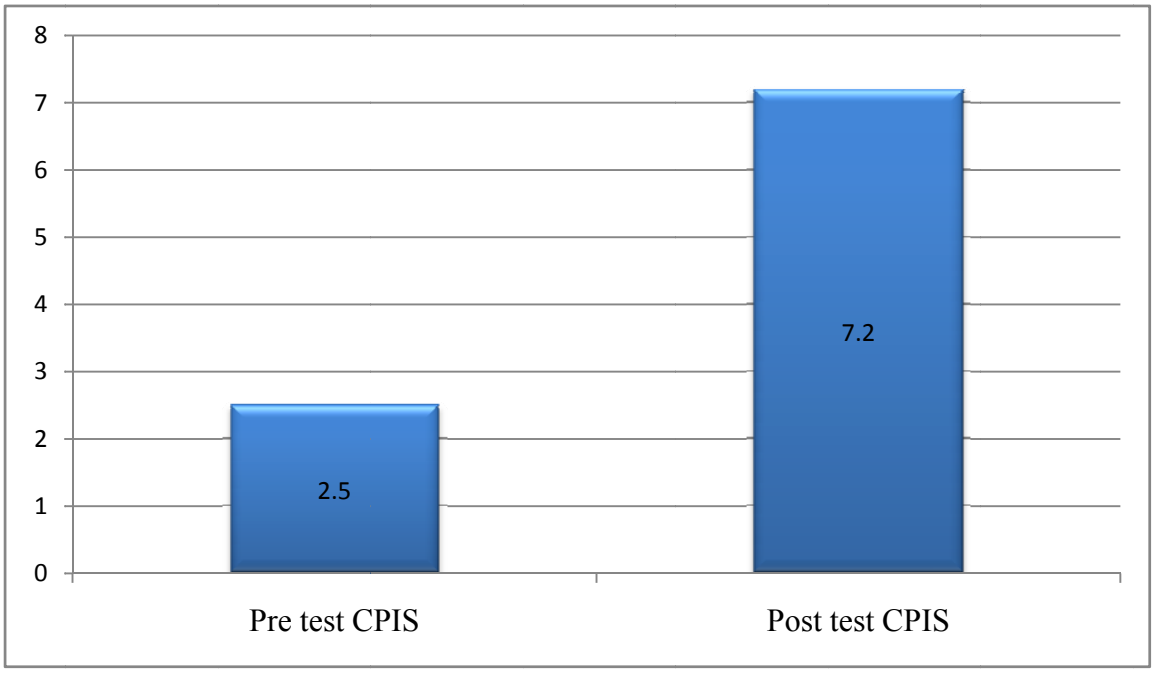


Fig 21: Comparison of pre and post test CPIS in control group

Comparison of Pre test CPIS between Intervention and Control group

Table: 6 Comparison of Pre test CPIS between Intervention and Control group N =20

Pretest CPIS	n	Mean	S.D	Independent 't' value
Intervention Group	10	2.4	0.89	
Control Group	10	2.5	1.76	0.25 (NS)

NS – Not Significant

Table 6 indicates the pretest CPIS of intervention and control group, which has a mean of 2.4 and 2.5 respectively. The obtained't' value is 0.25, which is not significant. Thus homogeneity exists between the intervention and control group before starting the intervention.

Comparison of Post test CPIS between Intervention and Control group

Table: 7 Comparison of Post test CPIS between Intervention and Control group N = 20

Posttest CPIS	n	Mean	S.D	Independent 't' value

Intervention Group	10	4.1	1.84	
Control Group	10	7.2	2.19	4.99*

P < 0.01

Table 7 reveals that the control group has a higher mean (7.2) than intervention group (4.1). The obtained‘t’ value is 4.99 which is significant at 0.01 level. Thus the modified oral care protocol with subglottic suctioning is effective in reducing the occurrence of VAP among intubated subjects in the intervention group than the control group.

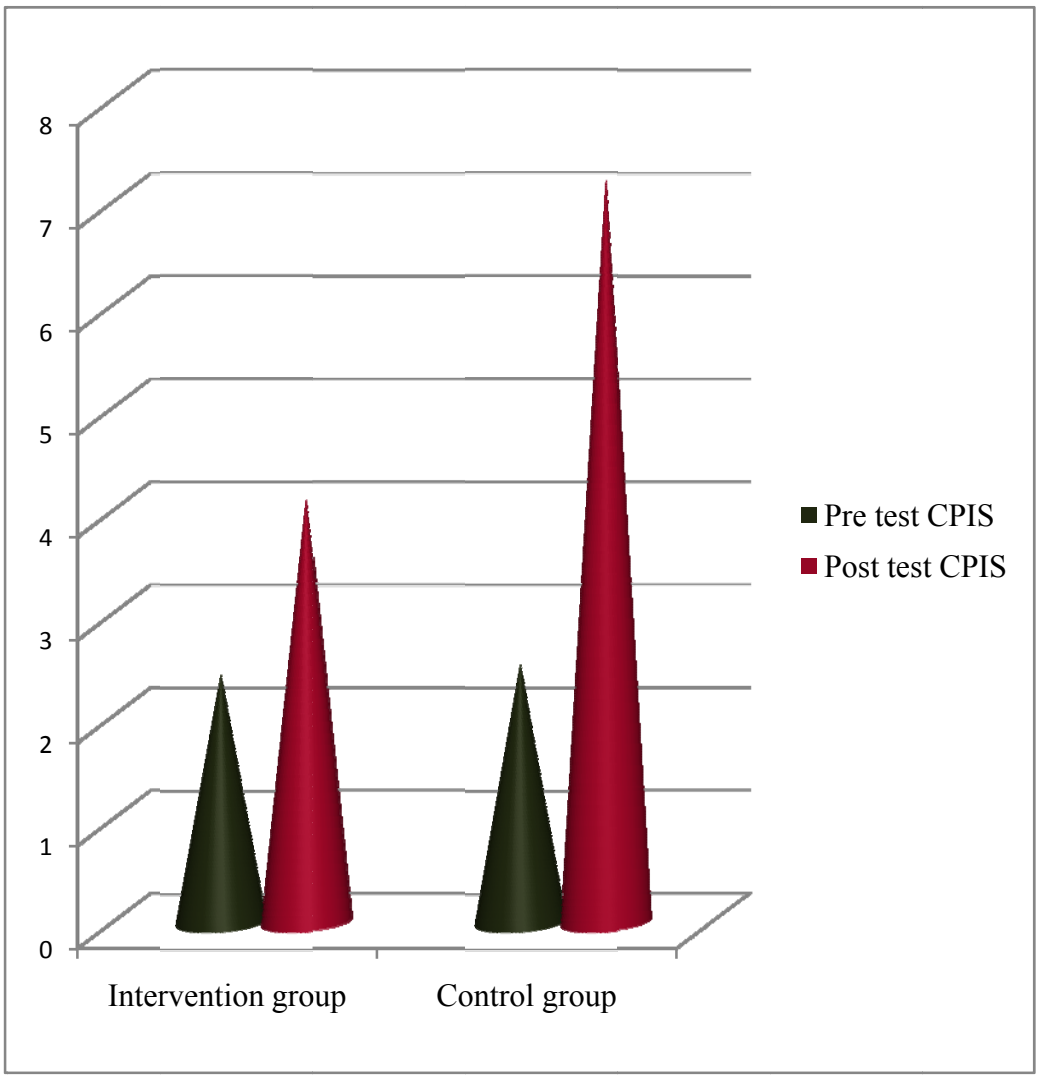


Fig 22: Comparison of Pre – Post CPIS of intervention and control group

SECTION E

Comparison of the occurrence of VAP among Intervention and Control group

Table 8: Comparison of occurrence of VAP using CPIS in Pre and Post test among intubated subjects in Intervention and Control group **N = 20**

	Pre test	**Post test**

VAP	Intervention group		Control group		Intervention group		Control group	
	n	%	n	%	n	%	n	%
Negative	10	100	10	100	7	70	2	20
Positive	0	0	0	0	3	30	8	80

Table 3 shows the occurrence of Ventilator Associated Pneumonia (VAP) based on Clinical Pulmonary Infection Score (CPIS). Only the subjects with a CPIS of less than six (VAP negative) were randomized to intervention and control group. After implementation of the intervention the posttest results reported the occurrence of VAP (CPIS > 6) in 30% (3) of the intervention group and 80% (8) of the control group.

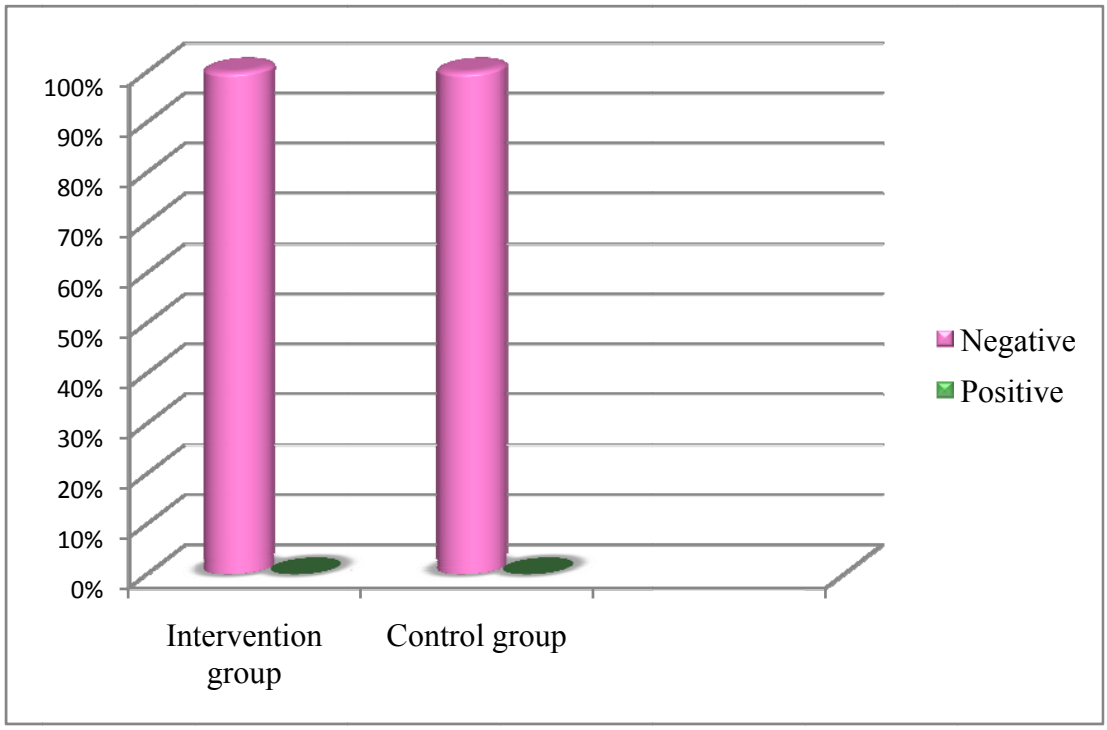


Fig 23: Pre test comparison of occurrence of VAP between intervention and control group

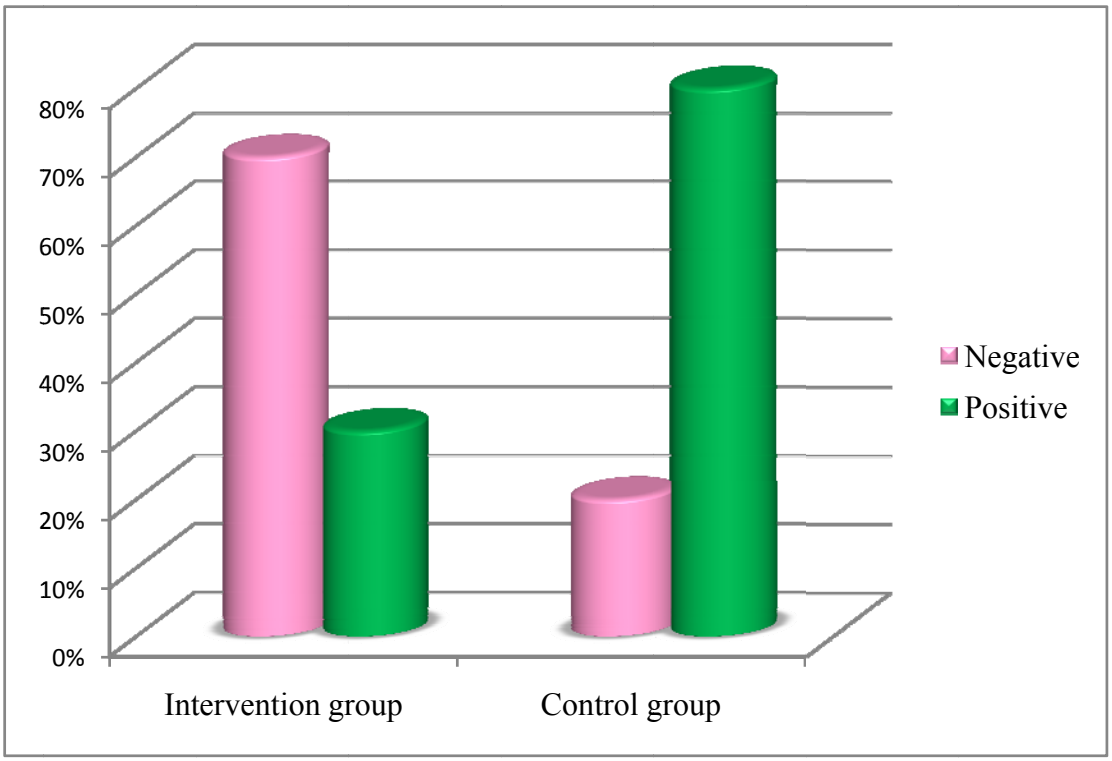


Fig 24: Post test comparison of occurrence of VAP between intervention and control group

CHAPTER V

DISCUSSION, SUMMARY, CONCLUSION, IMPLICATIONS LIMITATIONS AND RECOMMENDATIONS

This chapter deals with discussion, summary and conclusion drawn from the study. The study limitations, implications and recommendations in different areas of nursing practice, nursing administration, nursing research and nursing education in the future are considered here.

The Ventilator Associated Pneumonia (VAP) seems to be a major cause of death due to nosocomial infections, especially in Intensive Care Units. In the recent years many interventions have been developed and integrated as VAP prevention bundle. This study assessed the Effectiveness of Modified Oral Care Protocol with Subglottic Suctioning in reducing the occurrence of VAP. Incorporating this intervention in VAP prevention bundle helps to reduce VAP among mechanically ventilated patients.

This is a randomized control trial with pre test post test design, with the aim of evaluating the Effectiveness of Modified Oral Care Protocol with Subglottic Suctioning in reducing the occurrence of Ventilator Associated Pneumonia among intubated patients in intensive care units at KMCH, Coimbatore. The study was conducted among 20 patients, 10 in intervention group and 10 in the control group.

Data was collected for a period of six weeks in Medical and Surgical Intensive Care Units of Kovai Medical Center and Hospital, Coimbatore. On the day of admission the subjects were screened with the inclusion criteria and randomized to either intervention or control group. Then the patients in intervention group were intubated with a special Endotracheal Tube with subglottic suctioning port and received Modified Oral Care Protocol formulated by the investigator along with Subglottic Suctioning. Subjects in control group received routine care.

Clinical Pulmonary Infection Score (CPIS) was used to assess the occurrence of VAP among mechanically ventilated patients. The CPIS has six parameters and the total score is 12. The subjects were diagnosed to have VAP if their CPIS score is greater than or equal to six. Pre test CPIS was assessed for the subjects in both intervention and control group. The post test CPIS was done on the day of extubation or tracheostomy, or on the day on which the patient had a spike in temperature. The study findings are discussed in light of their objectives.

DISCUSSION

Majority of the study subjects were young adults in the age group of 18-45 years, with 60% (6) and in control group 50% (5). Regarding to the gender, 60% (6) and 90% (9) were males in intervention group and control group respectively.

The salient characteristics of the study subjects were that both the groups consists of a mix of patients with varied diagnosis such as trauma, poisoning, neurologic disorders, cardiovascular disease, and miscellaneous condition. The major reason for intubation was to protect the airway, with 60% (6) in intervention and 40% (4) in control group. Narrow spectrum antibiotics were administered to 70% (7) of the intervention group and 30% (3) of the control group. Broad spectrum antibiotics were used in 10% (1) of the intervention group and 50% (5) of the control group. Among intervention group, 60% (6) and in control group 50% (5) had GCS score less than eight. The patients receiving continuous NG tube feeding were 60% (6) in intervention group and 70% in control group. Intermittent NG tube feeding was received by 40% (4) of the intervention group and 30% (3) of the control group.

The post test CPIS parameters showed a notable difference between the intervention and control group subjects. Tracheal secretions were abundant in 70% (7) of the intervention group and 60% (6) of the control group. Chest X-ray infiltrates were diffuse in 80% (8) of the control group and no infiltrates was seen in 60% (6) of the intervention group. Majority of the subjects in both intervention and control group had high grade fever, 70% (7) and 90% (9) respectively. None of the subjects in intervention group and 80% (8) in control group had hypoxemia. Culture report documented the growth of gram negative organisms in majority of the control group subjects, 70% (7) and 30% (3) of the intervention group.

The first objective of the study was to estimate the occurrence of Ventilator Associated Pneumonia among patients receiving routine care.

In control group all the patients (10) found to have a CPIS score less than six in the pre test, which implies that none of them had VAP at time of pretesting and enrollment. But during the post test eight subjects were diagnosed to have VAP, with a CPIS greater than or equal to six. The mean pre test score of CPIS in control group is 2.5 and there is a sharp increase in the posttest mean to 7.2. The paired‘t’ value obtained is 15.80 which is significant at 0.01 level. This suggests that occurrence of VAP is high during the posttest period in the control group.

Smulders et al. (2002) studied the effect of subglottic suctioning on the incidence of VAP in mechanically ventilated patients by a randomized clinical trial. 150 patients were randomized equally to intervention group who were intubated with an endotracheal tube with intermittent subglottic drainage port and control group were intubated with a normal endotracheal tube. Clinical Pulmonary Infection Score (CPIS) was used to detect the VAP rate. Post test results revealed that VAP rate was 4% in intervention group and 16% in control group ($p = 0.014$). This finding is similar to the finding of the present study, that the VAP rate was high among the control group who received routine care than those who received drainage of subglottic secretions.

The second objective of the study was to determine occurrence of Ventilator Associated Pneumonia among patients receiving Modified Oral Care Protocol with Subglottic Suctioning.

The subjects in the intervention group received Modified Oral Care Protocol with Continuous Subglottic Suctioning from the time of intubation. During pretest none of them had a CPIS value greater than or equal to six. The posttest CPIS value indicated that three patients in intervention group had a score greater than or equal to six, suggesting VAP. The pre test CPIS mean is 2.4 and there is a slight rise in the posttest mean to 4.1. The paired't' value obtained is 5.37, which is significant at 0.01 level. This indicates that there is occurrence of VAP in the intervention group, because the endotracheal tube is a foreign body, which interrupts normal defense mechanism of the respiratory tract.

The third objective of the study was to compare the effectiveness of Modified Oral Care Protocol and Subglottic Suctioning with the routine oral care in reducing the occurrence of Ventilator Associated Pneumonia.

During pre test both the intervention group (10) and control group (10) were found to have a score below six. After implementing the Modified Oral Care Protocol with Continuous Subglottic Suctioning, the post test CPIS was assessed. The results showed that three subjects in intervention group and eight subjects in control group had a CPIS score greater than or equal to six, suggesting the occurrence of VAP. This clearly indicates that there is a reduction in the incidence of VAP in the intervention group than in the control group.

The mean pre test in the intervention group is 2.4 while that of control group is 2.5. The independent't' value is 0.25 which is not significant at any level. Therefore homogeneity is

maintained between both the intervention and control group before implementing the Modified Oral Care Protocol with Subglottic Suctioning.

For subjects in the intervention group, the post test mean is 4.1. The control group subjects have a mean of 7.2, which is significantly higher than the intervention group. The independent‘t’ value is 4.99, which is significant at 0.01 level. There is a significant increase in the post test mean of control group than intervention group, revealing that the Modified Oral Care Protocol with Subglottic Suctioning is effective in reducing the occurrence of VAP among intubated and mechanically ventilated patients.

In a single blinded study (Fields 2008) a performance improvement project for oral care of intubated patients documented a reduction in VAP rate from 4.265% to 0%. The interventions included in the performance improvement project are, the use of a soft bristled toothbrush instead of using toothette alone, application of a moisturizing ointment to the patient’s lips every 4 hours and oropharyngeal suction as needed. This protocol was implemented every eight hours for the patients in the intervention group. Within six months duration the VAP rate was 0%, so the control group was dropped and all the intubated patient’s teeth were brushed with toothbrush and the VAP rate was maintained as zero until the end of the study. These findings supported the current study that the regular implementation of a Modified Oral Care protocol can help in reducing the VAP rate among patients receiving mechanical ventilation.

Lacherade et al. (2010) determined the effect of Subglottic Secretion Drainage (SSD) in reducing the incidence of microbiologically confirmed VAP. In a randomized clinical trial 333 patients were enrolled with 169 in experimental who received SSD and 164 in control group who does not received SSD. VAP occurrence was confirmed microbiologically in 25 (14.8%) of intervention group and 42 (25.6%) of control group ($p = 0.02$). There was a remarkable reduction in the VAP rate in intervention group. This finding supports the present study result that there is significant reduction in VAP rate among the intervention group subjects who received Subglottic Secretion Drainage.

Substantiated by the study findings of various well controlled clinical trials conducted by (Garcia et al,2009), (Grap et al 2009), (Bousa et al 2008), it is clear that the implementation of a standard oral care protocol and subglottic secretion drainage is effective in reducing the occurrence of VAP. The findings of these clinical trials support the present study; moreover

there is a reduction in the occurrence of VAP from 80% (8) in control group to 30% (3) in the intervention group. This may be attributable to a small sample size.

Therefore the hypothesis - that there is a significant difference in occurrence of VAP between the subjects who received Modified Oral Care Protocol with Subglottic Suctioning and those who receive routine care, is accepted.

SUMMARY

The study was conducted to assess the Effectiveness of Modified Oral Care Protocol with Subglottic Suctioning in reducing the occurrence of Ventilator Associated Pneumonia among intubated patients in intensive care units at KMCH, Coimbatore.

MAJOR FINDINGS OF THE STUDY

- The resulting‘t’ value for pre test between intervention and control group is 0.25, which is not significant. This documents the homogeneity between the intervention and control groups before intervention.
- The obtained‘t’ value for pre test and post test in intervention group is 5.37, which showed a significant difference of CPIS between pre and post test after receiving the modified oral care protocol with subglottic suctioning.
- The‘t’ value for post test between intervention and control group is 4.99. This shows a significant difference between the intervention and control group after implementing Modified Oral Care Protocol with subglottic suctioning.
- The obtained‘t’ value for pre and post test CPIS in control group is 15.80, which explains clearly that the rate of occurrence of VAP is higher among the control group subjects.
- The post test CPIS was greater than or equal to six in 30% (3) of the intervention group and 80% (8) of the control group, suggesting VAP.
- Majority of the patients in intervention group, 70% (7) received narrow spectrum antibiotics, which is cost effective.

- Tracheal secretions were abundant in 70% (7) of the intervention group and 60% (6) of the control group.
- Majority of the patients in intervention group, 60% (6) had no infiltrates, where 80% (8) of the control group had diffuse infiltrates.
- A higher proportion of both intervention group (70%) and control group (90%) had a temperature $\geq 38.5^0$ c and $\leq 38.9^0$ c.
- Leucocytes count was normal in 60% (6) of intervention group and 40% (4) of the control group.
- PaO_2 / FiO_2 were greater than 240 and there was no evidence of ARDS in all the patients in intervention group.
- Endotracheal culture results showed the growth of pathogenic bacteria in 40% (4) of the intervention group and 90% of the control group.
- A predominant growth of gram negative organisms was noted in the control group.

CONCLUSION

The results of the study showed that there was a significant difference in the incidence of Ventilator Associated Pneumonia between the patients who received modified oral care protocol with subglottic suctioning and those who received routine care. The important aspect of VAP prevention bundle is proper oral care to those who are intubated and mechanically ventilated. The secretion pooled over the cuff in endotracheal tube is effectively drained by subglottic suctioning, which reduces the VAP rate. The investigator could not identify any complication during the execution of subglottic secretion drainage. The continuous suctioning pressure should be frequently monitored to avoid tracheal mucosal damage. Hence the hypothesis that there is a significant difference in the occurrence of Ventilator Associated Pneumonia between the patients who receive Modified Oral Care Protocol with Subglottic Suctioning and those who receive routine care is accepted. Combination of these two interventions seemed to reduce the VAP rate effectively.

IMPLICATIONS

The study has implication in different areas of nursing mainly, nursing practice, nursing education, nursing administration and nursing research.

Nursing practice

- Oral Care for intubated subjects should be demonstrated to the nurses in Intensive Care Units.
- Nurses follow the steps in oral care protocol of mechanically ventilated patients.
- VAP rate can be reduced to a greater extend with the proper implementation of Modified Oral Care Protocol and subglottic suctioning.
- A simple and clear protocol for VAP prevention should be formulated and made available to all Nurses in Intensive Care Unit, which includes eight hourly oral care and subglottic suctioning.

Nursing education

- Nursing students need to be educated about the steps of oral care protocol for intubated patients.
- Oral care should be taught, not only as an intervention for patient comfort. The contribution of oral care, oropharyngeal suctioning and subglottic drainage, in reducing VAP rate should be emphasized.
- Nursing curricula should include the prevention of various nosocomial infections and standardized recommendations should be taught to the students.
- Oral care for intubated patients should be taught to the students by vivid demonstration and students should do return demonstration.

Nursing administration

- Nursing administration need to establish standardized protocol to provide oral care for intubated patients.
- Nurse administrator should plan and organize continuing nursing education on prevention of nosocomial infections.
- Policies and protocol should be made clear to the nurses in Intensive Care Units about the prevention of VAP.

- Facilities to implement Modified Oral Care Protocol and Subglottic Suctioning should be made available.

Nursing research

- The study provides scope for future research on VAP prevention bundle.
- Utilization of evidence based facts improves overall quality of nursing care.
- Dissemination of study findings helps novice researchers to lay a better foundation for their research.
- Further research can be conducted to frame standard protocols to prevent nosocomial infection rates in health care settings.

LIMITATIONS

1. Study was limited to a small sample size.
2. Study was limited to the patients who were intubated within the intensive care units of KMCH, so generalization is not possible.

RECOMMENDATIONS

1. The study can be replicated involving larger population and sample for a longer period. So the findings can be generalized.
2. A similar study can be done in different settings.
3. A randomized control trial can be carried out to assess the effectiveness of standard oral care protocol and subglottic suctioning in reducing the incidence of VAP over a period of six months or one year.
4. The study can be done by selecting the patients based on APACHE II Score to determine the severity of illness, there by maintaining perfect homogeneity among both the groups.
5. A study can be conducted to compare the overall cost effectiveness of using an endotracheal tube with subglottic suction port and a standard endotracheal tube in relation to the treatment regimen of VAP, including antibiotic usage.
6. Further research can be conducted with four groups, first group receiving modified oral care protocol alone, second group receiving subglottic secretion drainage alone, the third group receiving a combination of modified oral care protocol and subglottic suctioning

and the fourth group as a control group receiving routine care. So that the effectiveness of oral care and subglottic secretion can be identified individually.

7. A study can be initiated to find the effectiveness of modified oral care protocol and subglottic suctioning in reducing the duration of developing early and late VAP.

ABSTRACT

The present study entitled "A study to assess the Effectiveness of Modified Oral Care Protocol with Subglottic Suctioning in reducing the occurrence of Ventilator Associated Pneumonia among intubated patients in Intensive care units, KMCH, Coimbatore" was undertaken in partial fulfilment of the requirements for the Degree of Master of Science in Nursing at KMCH College of Nursing, Coimbatore, which is affiliated to the Tamilnadu Dr. M.G.R. Medical University Chennai, during the year 2010-2011.

Objectives: To estimate the occurrence of Ventilator Associated Pneumonia among patients receiving routine oral care. To determine the occurrence of Ventilator Associated Pneumonia among patients receiving modified oral care protocol with subglottic suctioning. To compare the effectiveness of modified oral care protocol and subglottic suctioning with the routine oral care in reducing the occurrence of ventilator associated pneumonia. **Research Design**: Randomized control trial. **Setting**: Medical and Surgical Intensive Care Units at KMCH, Coimbatore. **Sample:** 20 patients, intubated in KMCH Intensive Care Units, 10 in intervention and 10 in control group. **Sampling Technique:** Non probability convenient sampling. **Tools:** Background variables, Clinical profile and Clinical Pulmonary Infection Score (CPIS**). Method:** On admission the subjects who met the inclusion criteria were randomized using lottery method to either intervention or control group. Pre test CPIS assessment was done for both the groups on the day of admission. Post test CPIS assessment was carried out on the day of extubation or tracheostomy or when the subject had a temperature spike greater than 102^0F. **Results:** There was a significant reduction in the occurrence of Ventilator Associated Pneumonia among patients in intervention group than the control group ($P < 0.01$). **Conclusion:** The results confirmed that the implementation of Modified Oral Care Protocol with Subglottic Suctioning is effective in reducing the occurrence of Ventilator Associated Pneumonia among intubated patients.

REFERENCES

1. Black,J.M., Hwaks,J.H., & Keene,A.M. (1997). Medical-Surgical Nursing. 6th ed. Philadelphia: W.B.Saunders company.
2. Braunwald., Fauci., Kasper., Hauser., Longo., & Jameson. (2001). Harrison's Principles of Internal Medicine. 15th ed. NewYork: Mc Graw Hill Medical Publishers.
3. Burns,N. & Groves,S.K. (1999). Uderstanding Nursing Research. 2nd ed. Philadelphia: W.B.Saunders company.
4. Dossey,M.B., Guzzetta,E.C., & Kenner,V.C. (1992). Critical Care Nursing. 3rd ed. Philadelphia: Lippincot company.
5. George,J.B. (2002). Nursing Theories – The base for professional nursing practice. 5th ed. New Jersey: Prentice Hall Publishers.
6. Grenvik,A., Aryes,S.M., Holbrook,P.R., & Shomeker,W. (2000). Textbook of Respiratory Medicine. 2nd ed. Philadelphia: W.B.Saunders company.
7. Gupta,S.P. (2007). Statistical Methods. 35th ed. New Delhi: Sultan Chand & and Sons.
8. Hall,J.B., Schmidt,G.A., & Wood,L.H. (2002). Principles of Critical Care. 2nd ed. New Delhi: Tata McGraw-Hill Publishing Company Limited.
9. Ignatavicus,D.D. & Workman,M.L. (2002). Medical Surgical Nursing Critical Thinking for Collaborative Care. 4th ed. Philadelphia: W.B.Saunders Company.
10. Kaplow,R. & Hardian,R.S. (2007). Critical Care Nursing. 1st ed. Boston: Jones and Bartlett publishers.
11. Kozier,B., Erb,G., Berman,A. & Snyder,S.J. (2007). Fundamentas of Nursing Concepts, Process and Practice. 7th ed. New Delhi: Pearson Education.
12. Lewis,L.S., Heitkemper,M.M., Dirksen,R.S. & O'Brien,G.B. (2009). Medical Surgical Nursing Assessment and Management of Clinical Problems. 7th ed. Missouri: Mosby.
13. Linton,A.D. (2007). Introduction to Medical Surgical Nursing. Missouri: Elsevier.
14. Marno,P.L. (2009). The ICU Book. 3rd ed. Philadelphia: Lippincott Williams & Wilkins.
15. Mayhall,C.G. (2004). Hospital Epidemiology and Infection Control. Philadelphia: Lippincott Williams & Williams.

16. Monahan,F.D., Sands,J.K., Neighbors, M., Marak,J.F. & Green,C.J. (2007). Phipps' Medical Surgical Nursing – Health and Illness Perspectives. 8th ed. Missouri: Missouri: Mosby Elsevir.
17. Morton,P.G. & Fontaine,D.K. (2009). Critical Care Nursing-A Holistic Approach. 9th ed. Philadelphia: Lippincott Williams & Wilkins.
18. Nayyar,V., Peter,J.V., Kishen, R. & Srinivas,S. (2008). Critical Care Update 2007. 1st ed. NewDelhi: Jaypee brothers.
19. Polit,D.F. & Beck.C.T. (2008). Nursing Research. 8th ed. Philadelphia: Lippincott.
20. Polit,D.F. & Hungler,B.P. (1999). Nursing Research, Principles and methods. 6th ed. Philadelphia: Lippincott.
21. Potter,P.A. & Perry,A.G. (2007). Basic Nursing – Essentials for Practice. 6th ed. Missouri: Elsevier.
22. Smeltzer,C.S. & Bare,G.B. (2008). Brunner and Suddarth's Text Book OF Medical Surgical Nursing. 11th ed. Philadelphia: Lippincott.
23. Taylor,C., Lillis,C. & LeMone,P. (1997). Fundamentals of Nursing – The Arts and Science of Nursing Care. 3rd ed. Philadelphia: Lippincott.
24. Tomey,A.M. & Alligood,M.R. (2006). Nursing Theorists and their work. 6th ed. Missouri: Mosby Elsevier.
25. Udwadia,F.E. (2007). Principles of Critical Care. 2nd ed. New Delhi: Oxford University Press.
26. Urden, D.L., Stacy,M.K. & Lough,E.M. (2006). Thelan's Critical Care Nursing. 5th ed. Missouri: Elsevier publishers.
27. Wilkins,R.L., Stoller,J.K. & Scanlan,C.L. (2003). Egan's Fundamentals of Respiratory Care. 8th ed. Missouri: Mosby.

JOURNALS

28. Berry,A.M., Davidson,P.M., Janet Masters. & Rolls,K. (2007). Systematic Literature Review of Oral Hygiene Practices for Intensive Care Patients Receiving Mechanical Ventilation. American Journal of Critical Care, 16 (1), 552-556.

29. Blot,S.I., Labeau,S., Vandijck,D., Van Aken,P. & Claes,B. (2007). Evidence-based guidelines for the prevention of Ventilator Associated Pneumonia. Intensive Care Medicine, 33(8), 1463-1467.
30. Chastre,J. & Fagon,J.Y. (2002). Ventilator-Associated Pneumonia. American Journal of Respiratory Critical Care Medicine, 165, 867-903.
31. Cutler,J. & Davis,N. (2005). Improving Oral Care in Patients Receiving Mechanical Ventilation. American Journal of Critical Care, 14(1), 389-394.
32. Davis,A.K. (2006). Ventilator Associated Pneumonia: A Review. Journal of Intensive Care Medicine, 21(4), 211-226.
33. Depew,C.L. & McCarthy,M.S. (2007). Subglottic secretion drainage: a literature review. American Journal of Advanced Critical Care, 18(4), 366-379.
34. Ewig,S., Bauer,T. & Torres,A. (2002). The pulmonary physician in Critical Care.4: Nosocomial Pneumonia. Thorax, 57, 366-371.
35. Ferrer,R. & Artigas,A. (2002). Clinical review: Non-antibiotic Strategies for preventing Ventilator-Associated Pneumonia. Critical Care, 6(1),45-51.
36. Fields,L.B. (2008). Oral care intervention to reduce incidence of Ventilator Associated Pneumonia in the neurologic intensive care unit. Journal of Neuroscience Nursing, 40(5), 291-298.
37. Garcia,R., Jendresky,L., Colbert,L., Bailey,A., Zaman,M. & Majumder,M. (2009). Reducing Ventilator Associated Pneumonia through advanced oral-dental care: a 48month study. American Journal of Critical Care, 18(6), 533-534.
38. Gentile,M.A. & Siobal,M.S. (2010). Are specialized endotrecheal tubes cost effective in preventing Ventilator Associated Pneumonia? Respiratory Care, 55(2), 184-196.
39. Grap,M.J. & Munro,C.L. (2009). Oral Care Interventions in Critical Care: Frequency and Documentation. Americal Journal of Critical Care, 17(2), 677-682.
40. Heyland,D., Cook,D., Dodek,P., Muscedere,J. & Day,A. (2006). A Randomized Trial of Diagnostic Tecniques for Ventilator Associated Pneumonia. The New England Journal of Medicine, 355(25), 2619-2630.
41. Hutchins,K., Karras,G., Erwin,J., & Sullivan,K.L. (2009). Ventilator Associated Pneumonia and Oral Care: a successful quality improvement Project. American Journal of Infection Control, 37(7), 590-597.

42. Koenig,S.M. & Truwit,J.D. (2006). Ventilator Associated Pneumonia: Diagnosis, Treatment and Prevention. Clinical Microbiology Reviews, 19(4), 637-657.
43. Kollef,H.M. (2009). The Prevention of VAP. The New England Journal of Medicine, 340(8), 627-633.
44. Kollef,H.M., Morrow,L.E., Baughman,R.P., Craven,D.E., McGowan,J.E., Micek,S.T., et al. (2008). Health-Care Associated Pneumonia (HACP): A Critical Appraisal to Improve Identifications,Management and Outcomes-Proceedings of the HACP Summit. Clinical Infectious Diseases, 46(4), 296-334.
45. Kollef,M.H. (2009). The Prevention of Ventilator Associted Pneumonia. The England Journal of Medicine, 340(8), 627-634.
46. Lacherade,J.C., De Jonghe,B., Guezennec,P., Debbat,K., Hayon,J., Monsel,A., et.al. (2010). Intermittent Subglottic Secretion drainage and Ventilator Associated Pneumonia: a Multicenter trial. American Journal of Respiratory Critical Care Medicine, 182 (7), 910 – 917.
47. Mahul,P., Auboyer,C., Jospe,R., Ros,A., Guerin,C., Khouri., et.al. (1992). Prevention of nosocomial pneumonia in intubated patients: respective role of mechanical subglottic secretions drainage & stress ulcer prophylaxis. Intensive Care Medicine, 18, 20-25.
48. Marcus,J.S. & Juffermans,N.P. (2010). Prevention of VAP: "WHAP" should we do?. Critical Care Medicine. 38(2), 706-707.
49. Mehta,R.M.B. & Niederman,M.S. (2003). Nosocomial Pneumonia in Intensive Care Units: Controversies and Dilemmas. Journal of Intensive Care Medicine, 18(4), 175-188.
50. Metheny,N.A., Jackson,J.D. & Stewart,B.J. (2010). Effectiveness of of an Aspiration Risk-Reduction Protocol. Nursing Research, 59 (1), 18-25.
51. Mori,H., Hirasawa,H., Oda,S., Shiga,H., Matsuda,K. & Nakamura,M. (2006). Oral Care reduces incidence of VAP in ICU populations. Intensive Care Medicine, 32, 230-236.
52. Munro,C.L., Grap,M.J., Jones,D.J., McClish,D.K. & Sessler,C.N. (2009). Chlorhexidine Toothbrushing and Preventing Ventilator Associated Pneumonia in Critically ill adults. American Journal of Critical Care, 18(5), 428-437.
53. O'Neal,P.V., Munro,C.L., Grap,M.J. & Rausch,S.M. (2007). Subglottic secretion viscosity and evacuation efficiency. Respiratory Nursing, 8(3),202-209.

54. Omrane,R., Eid,J., Perreault.,M.M., Yazbeck,H., Berbiche,D., Gursahaney,A., et.al.. (2007). Impact of a Protocol for Ventilator Associated Pneumonia. Ann Pharmacother, 49(9), 1390-1396.
55. Orlikowski,D., Sharshar,T., Porcher,R., Annane,D., Raphael,J.C. & Clair,B. (2006). Prognosis and risk factors of early onset pneumonia in Ventilated patients with Guillain-Barre Syndrome. Intensive Care Medicine, 32(1), 1962-1969.
56. Palmore,T.N. & Henderson,D.K. (2010). Testing the tube: Assessing Silver as a potential "Silver bullet" for Ventilator Associated Pneumonia. Critical Care Medicine, 38(4), 1220-1221.
57. Porzecanski,I. & Bowton,D.L. (2006). Diagnosis and Treatment of Ventilator Associated Pneumonia. Chest, 130(2), 597-604.
58. Rello,J. (2005). Bench-to-bedside review: Therapeutic options and issues in the management of Ventilator Associated Pneumonia. The New England Journal of Medicine, 340(8), 627-634.
59. Ruiz,M., Torres,A., Ewig,S., Marcos,M.A., Alcon,A., Lledo,R., et al. (2000). Noninvasive Versus Invasive Microbial Investigation in Ventilator-associated Pneumonia. American Journal of Respiratory Critical Care Medicine, 162, 119-125.
60. Safdar,N., Crnich,C.J. & Maki,D.G. (2005). The pathogenesis of Ventilator Associated Pneumonia. Respiratory Care, 50(6),725-739.
61. Sona,C.S., Zack,J.E., Schallom,M.E., McSweeney,M., McMullen,K., Thomas,J., et.al. (2009). The impact of a simple, low-cost oral care protocol on Ventilator Associated Pneumonia rates in a Surgical Intensive Care Unit. Journal of Intensive Care Medicine, 24(1), 54-62.
62. Tsai,H.H., Lin,F.C. & Chang,S.C. (2008). Intermittent suction of oral secretions before each positional change may reduce Ventilator Associated Pneumonia: a pilot study. American Journal of Medical Science, 336(5), 397-401.
63. Valles,J., Pobo,A., Esquirol,O.G., Mariscal,D., Real,J. & Fernandez,R. (2007). Excess ICU mortality attributable to Ventilator-associated Pneumonia: The role of early Vs late onset. Intensive Care Medicine, 33, 1363-1368.

64. Vallies,J., Artigas,A., Rello,J., Bonsoms,N., Fontanals,D., Blanch,L., et.al. (1995). Continuous Aspiration of Subglottic Secretions in preventing Ventilator Associated Pneumonia. Annal of Internal Medicine, 122(3), 179-186.

ONLINE JOURNALS

65. Bouza,E., Prez,M.J., Mufoz,P., Rincin,C., Barrio,J.M. & Hortal,J. (2008). Continuous aspiration of Subglottic Secretions in the prevention of Ventilator Associated Pneumonia in the postoperative period of major heart surgery. Chest, 134(5), 938-946. Retrieved from http://chestjournal.org/

66. Craven,D.E. (2006). Preventing Ventilator-Associated Pneumonia in adults: Sowing seeds of change. Chest, 130(1), 251-260. Retrieved from http://chestjournal.org/

67. Dodek,P., Keenan,S., Cook,D., Heyland,D., Jacka,M., Hand,L., et al. (2004). Evidence-Based Clinical Practice Guideline for the Prevention of Ventilator-Associated Pneumonia. Annals of Internal Medicine, 141(4), 305-313. Retrieved from http://www.annals.org/

68. Hoffken,G. & Niedermam,M.S. (2002). Nosocomial Pneumonia – The Importance of a De-escalating Strategy for Antibiotic Treatment OF Pneumonia in the ICU. Chest, 122 (6), 2183-2196. Retrieved from http://chestjournal.org/

69. Kollef,M.H., Skubas,N.J. & Sundt,T.M. (1999). A randomized clinical trial of Continuous Aspiration of Subglottic Secretions in Cardiac sugery patients. Chest, 116(5),1339-1346. Retrieved from http://chestjournal.org/

70. Poba,A., Lisboa,T., Rodriguez,A., Sole,R., Magret,M., Trefler,S. et.al. (2010). A randomized trial of dental brushing for preventing Ventilator Associated Pneumonia. Chest, 136(2), 433-439. Retrieved from http://chestjournal.org/

71. Shorr,A.F. & Kollef,M.H. (2005). Ventilator-Associated Pneumonia: Insights From Recent Trials. Chest, 128(5), 583-591. Retrieved from http://chestjournal.org/

72. Shorr,A.F. & O'Malley,P.G. (2001). Continuous Subglottic Suctioning for the prevention of Ventilator Associated Pneumonia: a potential economic implications. Chest, 119(1), 228-235. Retrieved from http://chestjournal.org/

73. Smulders,K., Van der Hoeven,H., Weers-Pothoff,I. & Vandenbroucke-Grauls,C. (2002). A randomized trial of intermittent subglottic secretion drainage in patients receiving mechanical ventilation. Chest, 121(3), 858-862. Retrieved from http://chestjournal.org/
74. Porzecanski,I. & Bowton,D.L. (2006). Diagnosis and Treatment of Ventilator Associated Pneumonia. Chest, 130(2), 597-604. Retrieved from http://chestjournal.org/

UNPUBLISHED THESIS

75. Lydia.G.M. (2010). Effectiveness of Oral Suctioning on Prevention of the Pulmonary Infection among Mechanically Ventilated Patients at Sri RamaChandra Medical Hospital. Unpublished Master's Thesis, Sri Ramachandra University, Chennai.

APPENDIX A
PART-I
SECTION -A
BACKGROUND VARIABLES

1. Age (in years)
    a) 18 - 45
    b) 41 - 60
    c) 61 – 80
2. Gender
    a) Male
    b) Female

APPENDIX B
PART-I
SECTION-B
CLINICAL PROFILE

1. Diagnosis
    a) Neurologic disorders
    b) Respiratory disorders
    c) Cardiovascular disorders
    d) Trauma
    e) Poisoning
    f) Others
2. Reason for intubation
    a) Respiratory failure
    b) Airway protection
    c) Hemodynamic instability
3. Usage of antibiotics
    a) Yes
    b) No
4. Name of the antibiotic_____

5. Antibiotics Classification
    a) Narrow spectrum
    b) Broad spectrum
    c) Combination

6. Receiving relaxant or sedation
    a) Yes
    b) No
7. Duration of relaxant and sedation
    a) Only on the day of intubation
    b) Intermittent bolus
    c) Continuous infusion
8. Glasgow Coma Scale
    a) 13-15
    b) 8-12
    c) <8
9. Nasogastric Tube feeding
    a) Intermittent
    b) Continuous

APPENDIX C
PART-II
CLINICAL PULMONARY INFECTION SCORE (CPIS)

S. No	**CPIS Points**	**0**	**1**	**2**
1.	Tracheal secretions	Rare	Abundant	Abundant + purulent
2.	Chest X-ray infiltrates	No infiltrate	Diffused	Localized

3.	Temperature^0 c	≥36.5and ≤ 38.4	≥ 38.5 and ≤ 38.9	≥ 39 or ≤ 36
4.	Leucocytes count per mm^3	≥ 4,000 to ≤ 11,000	< 4,000 or >11,000	< 4,000 or >11,000 + band forms > 500
5.	PaO_2/FiO_2, mmHg	> 240 or ARDS		≤ 240 and no evidence of ARDS
6.	Microbiology	Negative		Positive

APPENDIX D
MODIFIED ORAL CARE PROTOCOL

ORAL CARE:

Oral care is a part of personal hygiene and it is very important for the prevention of colonization of microorganisms in oral cavity for intubated patients. Oral care has to be given thrice a day at 6 am, 12 pm and 6 pm.

PURPOSE:

- To reduce the bacterial colonization in oral cavity and oropharynx.
- To prevent the formation of plaque.

SUPPLIES REQUIRED:

1. Paediatric toothbrush
2. Clean gauze pieces
3. Artery forceps
4. Povidine Iodine mouthwash 2%
5. Small bowl
6. Oral mouth suction catheters

7. Vaseline for lip care.
8. Non-sterile gloves
9. Facemask

PROCEDURE:	**RATIONALE:**
1. PERFORM ORAL ASSESSMENT: ❖ Perform hand hygiene and wear non-sterile gloves, facemask. ❖ After noting the lip level of endotracheal tube, remove the adhesives. ❖ Inspect the oral cavity, top, sides and undersurface of tongue, lips, back of throat and mucous membranes for any bleeding, odor, discharge or evidence of or ulceration. ❖ Inspect teeth to observe for breakage, missing tooth, dental caries or recent trauma. Inspect the gum for any swelling or abscess.	Infection in the ICU is commonly spread by contaminated hands of health professionals. Disruption of mucus membranes can be very painful and may increase risk for systemic infection. Dental caries increase risk for abscesses and oral infections.
3.BRUSH TEETH: ❖ Secure the endotracheal tube with one hand and hold it away from the side you are going to	Intubated patients are unable to maintain normal oral hygiene.

brush. ❖ Hold the brush at 15 degree and brush away from the gum line. ❖ Brush the teeth on inner and outer surfaces both above and below. ❖ Secure and hold the tube in other side and brush the teeth in the opposite side also. ❖ Rinse with 10 ml of water and do suction.	Brushing the teeth using baby brush can reduce the number of bacteria and prevent plaque formation. To clean the entire oral cavity. Oral secretions rich in bacteria are aspirated during intubation, even with intact endotracheal tube cuffs.
4.APPLY POVIDINE IODINE: ❖ Pour a small amount of povidine iodine in a small bowl. ❖ Soak a gauze piece in povidine iodine solution. ❖ Scrub along teeth, tongue and gum line using small circular motions. ❖ Ensure that gauze piece reaches above the gum line. ❖ Suction any remaining povidine iodine from mouth, but do not rinse. ❖ Ensure that endotracheal tube is in correct position and secure with adhesives.	Povidine iodine creates a film that adheres and remains on the teeth to provide antibacterial activity against microorganism. With prolonged use povidine iodine can stain the teeth. The reason for povidine iodine use should be explained to the family and they should be advised that any discoloration of teeth can be removed by dental cleaning. Presence of excess secretions may aspirate. Rinsing the povidine iodine will reduce its antibacterial activity. To prevent dislodgement.

5.PRN CARE: ❖ Cleanse mouth with clean gauze soaked in water every 4th hourly and PRN to maintain hydration. ❖ Apply Vaseline to lips after oral care and 4th hourly ❖ Perform oral suction gently before every position change. ❖ Remove gloves and perform hand hygiene.	Moisture helps to prevent oral mucosal damage. Emollient helps to prevent dryness of lips. Reduces risk of aspiration of oropharyngeal secretions during positioning.
6.DOCUMENTATION: ❖ Document oral care in flow sheet. ❖ Document abnormal findings.	

APPENDIX E
ROUTINE CARE

SUPPLIES USED

- 2% Povidine Iodine mouth wash
- Artery forceps

- Medicine cup
- Clean gauze
- Water for injection
- Oral suction catheter

PROCEDURE

- Note the lip level of endotracheal tube
- Remove the soiled adhesive tape
- Do oral suctioning as needed
- Pour 2% povidine Iodine mouthwash into the medicine cup
- Add 50% water for injection to the mouthwash
- Dip gauze in diluted povidine Iodine solution and clean the oral cavity (teeth, gums, tongue, oral mucosa)
- Do oropharyngeal suctioning to remove excess secretions
- Ensure accurate lip level of endotracheal tube
- Secure the endotracheal tube with adhesive tape
- Document the procedure
- Inform abnormal findings to the duty physician

APPENDIX F
PHOTOS

Endotracheal Tube with Subglottic Suction Port

Articles needed to perform modified oral care

Ensuring the lip level of Endotracheal tube

Performing oral care using Paediatric toothbrush

Cleansing oral cavity with saline dipped gauze

Suctioning excess secretions after oral care

Continuos aspiration of Subglottic Secretions

After implementing Modified oral care protocol and Subglottic Suctioning

LIST OF EXPERTS

1. Prof. DR. S. Madhavi, M.Sc.(N), Ph.D
Principal and Head of the Department of
Medical Surgical Nursing,
KMCH College of Nursing,
Coimbatore – 641 014.

2. Dr. M. N. Sivakumar, D.A., DNB., I.D.C.C.,
Consultant Critical Care Physician,
Kovai Medical Center and Hospital,
Coimbatore – 641 014.

3. Dr. Saravanan., MDS.,
Consultant Dental & Faciomaxillary Surgeon,
Kovai Medical Center and Hospital,
Coimbatore- 641 014.

4. Prof. C. Kulanthaiammal, M.Sc (N)., (Ph.D).,
Department of Medical Surgical Nursing,
KMCH College of Nursing,
Coimbatore- 641014.

5. Prof. K. Balasubramanian, M.Sc (N)., (Ph.D).,
Department of Medical Surgical Nursing,
KMCH College of Nursing,
Coimbatore-641014.

6. Prof. A. Raja, M.Sc (N)., (Ph.D).,
Prof & HOD of Department of Medical Surgical Nursing,
Sahyadri College of Nursing Mangalore-7.